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EDITED BY

THEO. S. CASE.

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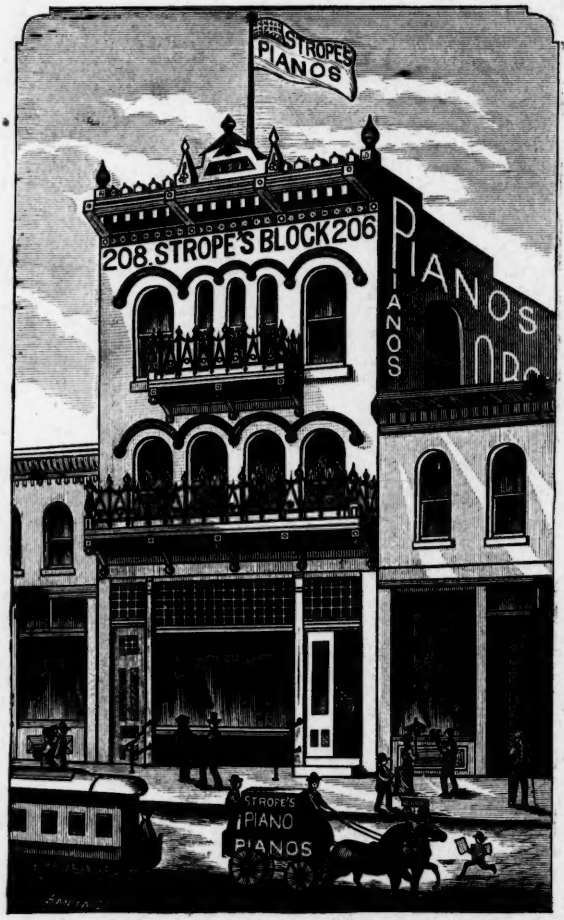

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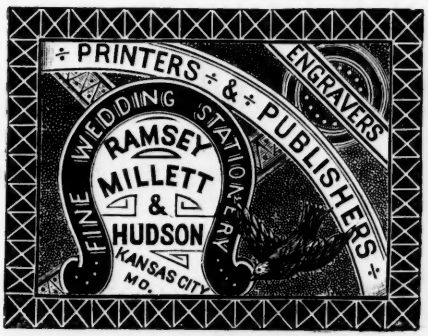

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VOL. VII. OCTOBER, 1883. NO. 6.

GEOLOGY AND MINERALOGY.

EXPLORATIONS IN THE JUDITH RIVER GROUP.

CHAS. H. STERNBERG.

I have thought that a more detailed account of our expedition to the Judith River than the one given in the April number of 1881, might be of interest, as all we can learn of that strange country with its buried remains of an earlier world, ought to be of interest to the readers of this interesting monthly. In August of 1876, I received instructions from Prof. E. D. Cope to join him at Omaha, for an expedition into a new country. We were soon on our way across the prairies of Nebraska, through the grand and impressive scenery of the Rocky Mountains and through the great high prairies that lay on top of the Rocky Mountains, through long stretches of sage brush, and grease wood. Down the beautiful Wiou and Echo cañons, holding our breath for very wonder, as new scenery presented itself to our astonished vision. Who can ever forget a journey through these magnificent cañons, where beetling crags line and shut us in and lilliputian forests have sprung up on either side in singular contrast to the mighty mountains that tower above. It is a scene long to be remembered: the hand of nature through her forces has cut and fashioned these mighty gulches, providing drainage channels for the rains that fall on the high prairies to the east. At Ogden we took the narrow gauge railroad for northern Utah and left the train at Franklin, Idaho. Here a journey of 600 miles awaited us. Who can tell of the discomforts of this journey, but those who

have made it? For 200 miles we traveled at the rate of ten miles an hour through the barren alkali desert of Idaho, great clouds of dust enveloped us and penetrated our clothing, giving us all a death like appearance; three times a day we stopped an hour at dirty stage stations, where for the small sum of one dollar we ate hot bread and bacon, and drank strong, clear coffee; the proprietors had evidently not settled here for their health but for dollars. One very unhappy accident occurred on the stage that preceded us. The driver fell from his seat, and the horses ran, tipped over and dragged the stage for some distance. One large man was severely injured and was taken into a stage station. Three months later he was still lying there helpless, I never learned whether he recovered but think it doubtful. Well, we passed safely through the Port Neuf Cañon, where road-agents usually called on the passengers to stand and deliver. The mountains were hailed with delight, and we were soon amid the pines, and at Pleasant Valley we feasted on trout, and thereafter our fare was much better. At Helena we rested a couple of days and then proceeded to our outfitting post, Fort Benton, at the head of navigation on the Missouri River, a rough, frontier town where gambling seemed to be the chief business, in connection with drinking whisky.

Here we procured our outfit, consisting of four work horses, a large wagon, and three saddle horses, tent, rations, etc. We traveled down the Missouri River, and went into camp at Dog Creek, sixty miles below. This creek is a few miles from the mouth of the Judith River. I will try and give my readers some idea of the hardships and sufferings that fall to the lot of the explorer. We were in an unknown country with neither trail or wagon road, and we were in a dangerous country. Our fossil fields lay in the neutral grounds of the Sioux and Crow Indians. Here, though they had always been deadly enemies, they buried the hatchet while they hunted buffaloes, in the great Judith River Basin, for the sustenance of their squaws and little ones. In this country were countless herds of mule-deer and antelope, and the high prairies were dug up by grizzly bears for wild artichokes. The rich prairies and along the mountain sides were covered with luxuriant bunch grass, providing an endless food supply; it cures early in fall, and is superior to hay during winter. The Bad Lands along all the water courses are full of mountain sheep. It is indeed a veritable hunter's paradise, and is the great store-house from which the Indians for many years have drawn their supplies. The soil is rich from the accumulated mold of centuries. The basin is miles and miles in extent, and is bounded by the Judith River and Medicine Bow Mountains: countless streams of pure water flow through it. After the buffalo and Indians have disappeared it will make one of the grandest farming lands in America. When our party visited this beautiful country it was entirely under the sway of the red man. No cattle grazed on the rich grasses. The bosom of mother earth had never felt the sharp plow-share. No adventurous frontiersman had built his cabin along the clear stream. From these facts you will understand the dangerous land we were in.

Prof. Cope's first work on reaching Fort Clagget was to make friends of the Crow Indians: a couple of thousand were camped here when we arrived, prepar-

ing to go on their annual buffalo hunt. An amusing incident occurred here. The Professor had taken out some false teeth and was washing them; some Indians saw him, and when he replaced them in his mouth their astonishment was unbounded. When they found their voices they called out, "do it again, do it again"; and the next day they brought over a number of others to see the wonderful feat. After that the Professor was a great man in their estimation, if he had had a cork leg and glass eye they would doubtless have fallen down and worshipped him. The Professor so won the respect of the Crows that none of us were molested. We saw a few days afterwards the profligacy with which they destroyed their choicest fruit. We were following their trail up the Judith River and found on either side great quantities of the branches of berry-bushes scattered along: the Indians had rode up to the bushes and cut off branches, after eatitg the berries they had thrown them down. They call them the bull-berries and it is a nice acid fruit.

We also saw where the squaws had cut down a great many large cottonwoods with their chisel-shaped axes, the only use they made of them was to cut off the dead branches from the top of the trees, choosing only those that were dry and hard and without bark; they burn them in their wigwams, as they make good coals and but little smoke. I never saw so many well formed men in my life among the same number, as I saw among these River Crows, and was told that the Mountain Crows were still larger. They will prove a formidable enemy should they ever take the war path.

We were camped in August, 1876, on Dog Creek under some large cottonwoods. The Bad Lands presented their bold escarpments, or steep hill-sides on either side. They assumed all the characteristics of Bad Land scenery, rugged hills, rounded mounds, sharp pinnacles, long narrow ridges, etc. Some of the hills reached a height of 1,200 feet above the creek level. They were composed largely of the black shales of the Fort Pierre Group, through which were scattered beds of soft coal, or lignite, from a few inches to six feet in thickness. These Bad Lands will be the great fuel producers for the farmers of the great treeless plains, that extend far north into the domains of England. The Bad Lands of the upper Missouri present a scene of singular barrenness, and desolation: the blackness of the hills is covered up in places by sage brush, greasewood and cactus.

The shale disintegrates readily and produces a loose dirt into which one sinks a foot, this prevents one from sliding down the hill, as the accumulated dirt stops his downward progress. This dirt is carried down by every rain and helps augment the number of mud banks in the Missouri. At this point, except during high water, the river is clear; it receives its characteristic color from the Yellowstone. On top of the Fort Pierre shales are the buff-colored sandstone of the Fox Hills Group, then the yellowish clays of the Judith Group. It is a fresh and brackish water deposit, and has three beds of rusty sandstone, and a few beds of lignite. On top of the whole is a large bed of oyster shells, showing that at the close of the cretaceous and for the last time the sea again gained access: these are the transition beds between the cretaceous and tertiary, or the age of reptiles and

mammals. They are usually barren of vegetation and are covered with angular cherty fragments, that roll under the feet, making travel dangerous and difficult. I forgot to mention beds of unios that are found in this formation, I discovered in one place where a bed of lignite had burned out, baking and coloring the under and overlying clays: the rock resembled the red stone from the pipestone quarries of Minnesota. The beds of the Judith River have been studied and their stratigraphy made out by the famous U. S. Geologist, Prof. F. V. Hayden. While collecting here a great many years ago, he was chased by some Blackfeet Indians, his collections turned out, and he was ordered to leave the country, which he did. He fortunately had a few teeth and turtle shells in his pocket which the Indians had not destroyed: they were studied by Dr. Joseph Leidy, the father of American palæontology, and were prophetic of the rich store that lay in wait for the successful explorer who braving the dangers from Indians, should explore and collect in this *terra incognita:* the accomplishment of this feat is due to Prof. E. D. Cope. He reasoned when the country was astonished by the news of the fearful slaughter of Custer and his brave 7th Calvary, that all the able-bodied warriors would be south fighting the soldiers, and their squaws and little ones would be secreted in the mountains. He thought we would be able to explore the country and return when the Indians, under Sitting Bull, were driven north by the troops. His reasons were good, and in proof we were so fortunate as to add forty new species of strange animal life to science. They belonged to the extinct Dinosaurians, great land animals that partake of the characteristics of birds, reptiles and mammals. In fact some comparative anatomists claim that these three great families owe their descent to the Dinosaurians. Their bones were hollow and bird-like. The species we discovered walked on their hind limbs, which were large and pillar-like; a heavy tail helped support their ponderous weight while feeding from the branches of trees; their front limbs were arm-like and were provided with claws.

The plant eaters were provided with three rows of teeth in each jaw, thus giving a large grinding surface: under each old tooth was a hollow cylinder containing five young teeth, which were pushed upwards: as fast as a tooth was worn out another took its place. These huge animals reached a height of over twenty feet, their enemies, the flesh-eaters, were smaller and provided with powerful claws, and long recurved teeth with serrated edges: there was a single row in each jaw, they were elegantly built, and well adapted for springing on the clumsy plant-eaters. The waters abounded in sharks, gars, etc., among fishes; also batrachians and turtles: these last had elegantly sculptured shells composed of ridges, grooves, punctures, and elevations, made with mathematical precision. Great numbers of unios and other fresh water shells abounded.

I discovered a new species of the shark family: the teeth were six-sided with a line down the long axis of the grinding surface, on one side of which was black enamel with white on the other. They were arranged in the roof and floor of the mouth like bricks in a pavement, and were used as a mill for grinding up food.

We were early in the saddle, and taking a lunch of hard-tack and bacon, we started for our fossil fields, returning at sundown. We suffered a great deal from clouds of minute black gnats, that got under our hat-rims, inflicting severe wounds causing the forehead to swell and giving much pain. We also suffered from thirst in the hot arid beds. One day, I remember while very thirsty, I saw a stream of water in a deep cañon: after much labor I reached it only to find that it was so strongly impregnated with glauber salts as to unfit it for drinking. I never after that tried to find a drink in the Bad Lands. Prof. Marsh in writing about the fossil fields of the northwest, has likened them to veritable battle-fields, where the remains of the slain lay scattered about, and it requires much work and exposure to wrest them from dame Nature. She never gives up her choicest treasure without a severe struggle.

I was so unfortunate as to have for a saddle pony a half wild mustang. He was a black, vicious little fellow, and more than once attempted to kill me. One day, near Cow Island, I had picketed him on a high table-land of about two acres in extent and surrounded by deep cañons, with a difficult trail leading over it. I noticed that he stood very still while I climbed into the saddle; he was usually restive and ready to start the moment I put my foot in the stirrup. The moment I gained my seat he started on a full run across the level space that separated us from a deep cañon, the curb was broken and the reins were as worthless in my hand as a bit of straw. I feared that he meant to hurl himself over the precipice, but when he reached the edge he stopped suddenly, expecting me to go over his head into the deep gorge below. Fortunately I kept my seat; turning as quick as a flash he rushed at full speed to the other side stopping suddenly with his feet planted within a few inches of the brink. Once more he made an attempt to dismount me, and again failed; he then gave up and allowed me to dismount. After fixing the curb I made him pay for his murderous attempt by riding him at full speed over hills and valleys for several miles.

I had another experience that nearly cost me my life and that I can never forget. I was following along a steep slope between two ledges of sandstone, the surface was covered with loose dirt into which I slipped until stopped by the accumulated dirt. I came to a place where the upper sandstone ledge had broken loose, and carried with it all the dirt, laying bare and polishing the underlying rock. Below, the second sandstone ledge had broken off and there was a sheer descent of several hundred feet. On my hands and knees I started to cross, and midway began to slip. I struck my hand-pick on the rock expecting to thus stop, but the sharp pick rebounded as if I had struck granite with it. My case now appeared hopeless, as I was fast approaching the brink of the fearful precipice; by some means I never knew how, I succeeded in reaching the loose earth at a point within a few inches of the descent. I suppose that when I first started over, my clothes, being very dusty, were the means of preventing my slipping, and in my frantic efforts for life I got other parts of my clothes next to the smooth surface; that helped stop my downward motion, and thus enabled me to reach a place of safety. We found a number of nearly perfect skeletons of Dinosaurs

near Cow Island. The Professor left us to take the last boat down the Missouri. The night before he went on board we had gone out to some beds on an open prairie twelve miles south of the river, and delaying too long, night overtook us just as we reached the breaks of the Missouri. I advised the Professor to stop where we were until morning, as I would much prefer to sleep in the open air and go without supper, than to make such a dangerous attempt as to try to reach the river at night, with no trail and deep cañons on either side, but he thought he saw the lights of the steamer that he must take, and fearful of missing it, he determined to reach the river if it took all night. After four or five hours of the most dangerous and difficult traveling I ever engaged in, we reached our destination. When night overtook us we were 1,200 feet above the Missouri, the cañons that surrounded us looked so black that the darkness could almost have been cut. We would follow an old buffalo trail to find it washed out. Would get nearly to the river and find a yawning gulf of inky darkness beneath our feet and have to retrace our way to the top of the Bad Lands. We, of course had to lead our horses and feel our way with the greatest caution, as one misstep would hurl us into eternity. I would gladly have stopped, but the indomitable energy of Professor Cope that knew of no defeat, won us victory, and we accomplished what no one else had ever done, namely, to reach the river after night from the high prairies south of it. The boat had indeed arrived, and we had just enough time the next day to get the Professor's things up to the landing.

Mr. Isaac and myself remained at Cow Island until the first of November, when severe cold weather forced us to retreat to Fort Benton, which we reached in safety. From this point I took the stage for another journey of 600 miles and suffered very much through the mountains, where the mercury fell to 20° below zero. But the Union Pacific train was at last reached and I was speeding eastward, and before many days was walking the streets of Philadelphia in time to see some of the wonders of the Centennial buildings.

The results of our three months expedition have been published by the Government and a new chapter added to the palæontology of North America.

THE LEAD AND ZINC REGION OF MISSOURI AND KANSAS.[1]

F. L. CLERK.

The lead and zinc region of Southwest Missouri is known to embrace the greater portion of Green, Dade, Lawrence, Jasper, Newton, and McDonald Counties, and to it adjoins the mineral region of the eastern part of Cherokee County, Kansas. Throughout the whole of this region, both lead and zinc have been found; but the most productive district, and the only one at present worked, is confined to the northern half of Newton County, the southern half of Jasper

1 From advance-sheets of *The Mineral Resources of the United States*, published by the United States Geological Survey, Department of Industrial Statistics. Albert Williams, Jr., Chief of Department.

County, and the eastern end of Cherokee County, Kansas, and to the area drained by the three streams, Center Creek, Turkey Creek, and Shoal Creek, which flow west and north and empty into Spring River within six miles of each other. In this region, the towns of Granby, on the south, and Joplin, on the north, are the centers of the principal mining activity. A very careful and intelligent account of this region, so far as it had then been developed, is to be found in the report of Dr. Adolf Schmidt and Mr. Alexander Leonhard, published in the Geological Report of the State of Missouri for the year 1873–74, to which the reader is referred. Work on the survey was interrupted in 1876, and has not since been resumed, for which reason few reliable statistics have since been published. The importance of this region as a source of zinc ore dates from the year 1871. In this year, the first regular shipments of ore were made from Granby to the zinc-furnaces at Carondelet. The discoveries of rich deposits of lead ore at Joplin in the same year, and their wonderfully rapid development, had also an immediate effect on the prosperity of this region. Here, as in Wisconsin, the discovery of zinc ore is proportional to the activity in prospecting for lead ore. The production of zinc ore for the year 1874 is given as 19,000 tons, and the present output is variously estimated at from 1,000 to 1,500 tons a week. There is no doubt that the latter figure is often reached, and could be maintained from present developments, except when mining is extensively interrupted either by wet weather or excessively low prices for lead or zinc ore; or that more than two-thirds of the spelter made in this country comes from ore mined in this region. The ore is found in the sub-carboniferous formation, and there is an evident connection between the known deposits of ore and the present system of surface drainage. Dr. Schmidt observed, as a remarkable fact, that the largest deposits do not lie along the principal streams, but at the heads of the smaller tributaries. The deposits of Webb City, Carterville, Empire, Galena, Sherwood, Belleville, and Blende, discovered since his examination, and now the principal sources of zinc ore, fall under the same rule. These throw new light upon the character of the mineral formations, and seem to warrant increased confidence in their extent and depth. The most important zinc mines of this region are those at Carterville and Webb City, which are really parts of the same deposit. They produce more than half of the zinc ore raised, and are worked principally for zinc ore.

As these deposits are very regular in their formation, and in a measure rule the ore market, and as the method of mining them is essentially the same as prevails throughout the entire district, a general description of them and the method of mining them will here be given. These mines lie in the open prairie, which was once cultivated in farms, about five miles northeast of Joplin, near the head of a small branch of Center Creek. They were discovered about the year 1877. Here, at a depth of from 40 to 100 feet, and often under a cap of limestone and flint 60 feet in thickness, has been found an immense deposit of zinc blende, which has been worked continuously for over half a mile. The deposit is in the form of a bed of flint, traversed in various directions by solid bars of barren flint

but in general resembling a breccia of sharp, angular pieces of flint, closely cemented by crystallized blende with occasional masses of bright, crystallized galena. With the exception of these bars and occasional pillars to support the roof, the whole body is blasted out. Draining is difficult, and rock drifts are sometimes necessary to unwater the ore. Dr. Schmidt considers a secondarily deposited quartzite to be the cementing material between the chert and the zinc-blende in the very similar deposits found at Oronogo; but this is certainly not the case in the best mines at Webb City nor at Sherwood, and zinc-buyers soon learn to detect the difference. Where the cementing material is pure blende, the blende breaks freely from the chert, and can be almost entirely cleaned by crushing and jigging; where the cementing material is quartzite, or black sand, as the miners call it, crushing is difficult, and a satisfactory separation is impossible. The mines spread over about a section of land, 640 acres. Their weekly output is about 700 tons. The method of working them is as follows: When a good prospect is discovered in new ground, the land around it is leased from its original owners, on royalties ranging from 10 to 25 per cent, by a number of individuals, who organize various mining, or as they would more properly be called, land companies. These companies have the land divided up into lots 200 feet square, and a plat of it made; select certain lots for themselves, and throw the others open to miners. They usually start a shaft on one of their own lots, and put in a pump. If the indications continue good, many of the lots, particularly those near the pump-shaft, are quickly taken up by parties of miners, who sink shafts upon them, timber the ground, put up hoisting contrivances, furnish all supplies, and bear all expenses.

When ore is struck, it is drifted on and followed in all directions up to the boundaries of the lot in question. The ore is raised to the surface and crushed and washed by the miners, and is sold to one of the zinc or mineral buyers. It is weighed over the company's scales, and paid for to the company, which deducts a royalty of 25 per cent on zinc-blende and 50 per cent on "mineral" (galena); and if it has pumps running, a pump rent of $1 a ton on zinc ore and $2 on 1,000 pounds of galena; and pays over the balance to the miner. The royalties, of course, vary with circumstances, but the above are general. The holders of lots hire other labor to do the mining at from $1 to $1.50 a day; and usually put up crushing and washing machinery on their lots. Very often the same parties control two or three adjoining lots or fractions of lots, and sometimes neighbors go into partnership. Most companies do not allow ores to be taken from the lots on which they are mined until they have been cleaned and have paid royalty. The machinery is usually of the simplest description—a farm or small stationary engine, covered by a shed of rough boards, a small-sized Blake's breaker, set over a pair of rolls, and a horse whim or whip. The jigs are ordinary hand-jigs, with an overhead breakstaff, working a sieve 2x3½ feet up and down in a box of water. The jigging is usually done by contract, and is paid for by the ton of cleaned ore. It is common to see from ten to twenty jigs grouped together under a shed of poles, covered with branches of trees or rough boards. The ore as

crushed yields from 10 to 50 per cent of cleaned ore, and the No. 1 grade assays about 60 to 62 per cent of metallic zinc. The tailings must in most cases be piled up on the lot from which they have come; they are drawn up into a mound with two-horse scrapers or belt elevators, and it is not an unusual sight to see jigs and crushing machinery perched on top of these mounds fifteen or twenty feet above the surface level, the shafts being timbered up to a corresponding height. Several land companies have put in fairly effective pumping machinery. Plunger-pumps working in pairs, with wooden walking-beams or bob cranks, and driven by gearing and a crank-shaft, are the most common; but direct-acting steam-pumps, like the Worthington or Blake, have been largely introduced of late, notwithstanding the disadvantages they labor under from the gritty water of the mines. From a distance, these mines, with their swarms of busy men and heaps of tailings piled around the shafts, remind one strongly of gigantic ant-hills, and present a sight not soon to be forgotten. No one can fail to be struck with the glaring defects of such a method of mining, the absence of system, the useless duplication of machinery, the cheap yet expensive expedients, and the crowding together of conflicting operations. Below ground, the effects are, if possible, worse. Each lot is affected by the policy of its neighbors; pillars are left only when they are thought to be absolutely necessary; each miner tries to get as much as possible out of his own lot, is only interested in it as long as he expects to work it, and is not disposed to improve the value of adjoining lots by unwatering them or proving their ore. The roof and pillars are badly trimmed, and in many cases dangerous, fatal accidents being distressingly common. The officers of the land companies are generally individually interested in one or more lots, and all sorts of questions are continually arising from the conflicting interests of the company and miners.

Looked at altogether, as the main dependence of the zinc industries of this country, such a condition of affairs is far from satisfactory, and yet it is not easy to suggest a practicable remedy. If a single company with sufficient capital could control all the lots and work them in connection with each other, the output could be largely increased, the cost of mining and dressing the ore greatly reduced, and the value of the mines kept up for a longer period, and the ore could be sold to better advantage than can be hoped for under the existing method. But this is seldom possible after the present system is once in operation; too many individuals have acquired rights in the mines, which they value at what they hope to get out of them. Nor is the present arrangement without obvious advantages in a new country, and it is seriously questioned whether any other could be as effective or as economical. When mineral is once discovered, it requires but little capital to open mines, and conseequently the individual risks are small. The miners, working on their own account, with hopes of large ultimate gains, have every inducement to work hard and cheaply, and to follow every clew that may lean to the discovery of ore. There is a large body of keen, hard-working prospectors, who during the season wander from place to place, live in wagons, under tents, or in open air, and carefully observe and follow every real or sup

posed indication of ore. How else, it may be asked, could prospecting be so well or so cheaply done? And there is a class of enterprising, skillful, well-to-do miners, naturally associated as partners, who have made one or more good strikes, and are always ready to take hold of any new venture that promises well, either in working a lot or in forming a land company to open new mines. Where else could be found capitalists so willing to risk their money in a speculative venture? Men of this sort are always ready and able to work themselves, or to direct the work above or below ground. How else could be obtained as willing and watchful superintendents, foremen, and clerks? New towns are started every year, and the mining district is rapidly extending. No uniform development seems to lead to this extension; chance and the policy of the land-owners appear to be the only determining causes.

The towns of Galena and Empire, on Short Creek, in Kansas, were brought into sudden prominence in 1878, and restored the waning fortunes of the Joplin region, by the exertions of two land companies, which, on the strength of two or three rich but undeveloped prospects, laid out two rival towns, and sold town-lots without reserving mineral rights; and by extensive advertising throughout Missouri and neighboring States, created an excitement which had a purely speculative basis, but led to the collection of a large number of miners and a considerable aggregate of money. Fortunately, the results very nearly justified their most sanguine representations. The land companies then withdrew all of their remaining lots from the market, and the success of the mines was secured. They are now the principal mines for lead ore in the region, and their output of zinc is increasing.

For the discovery and working of shallow deposits, the present system seems the best that can be devised; but it is clearly not adapted to solve the problems of discovering deeper deposits or working them to advantage. No system can be defended which involves extravagant expense in mining and preparing the ore for market, forces the sale of it without regard to its value, and renders worthless large bodies of ore that might be profitably worked by a better system; and no basis for a great industry, like the zinc industry, which makes it depend on a hundred chances independent of the price of metal, the cost of smelting, or the known deposits of ore, can be considered very safe to build upon. The caving in of a single mine, the breaking down of a pump, less activity in lead mining, or the scattering of the miners to richer camps may cause a falling off in the output of ore from which it would be very difficult to recover. That mining has on the whole been very profitable in this region, is established from the fact that the country around has steadly and rapidly increased in wealth and population. Within the last few years, three railroads, the St. Louis & San Francisco, the Missouri Pacific, and the Kansas City, Fort Scott & Gulf, have built branches through the ore-fields to each of the three towns, Joplin, Webb City, and Galena. Joplin, with its good streets, gas and water-works, machine-shops and foundries, flour and woolen mills, lead and zinc furnaces, street-cars, and extensive jobbing and retail houses has been built almost entirely from the profits of mining.

Granby, twenty miles southeast of Joplin, presents a striking contrast. It is dependent on a single railroad, which owns much of the mining land; and the land is all leased or owned by the Granby Mining and Smelting Company. Lead ore has been extensively mined since 1856, and during the war the mines were worked for both armies. The zinc ore obtained is mainly calamine, but blende is also found. The mines are in general shallow and less troubled with water, the ores usually require less mechanical dressing than at other points in the lead region. The company receives from the men all of the lead and zinc ore, deducts the royalties paid to the railroad and its own royalties, and pays the miner on a sliding-scale, based on the price of the metallic lead and the selling price of zinc ore, for the reason that it smelts the lead ore, and at present sells the zinc ore.

This mining point is noteworthy, as it is the only one producing large amounts of calamine. The calamine is naturally rich, not much contaminated with other materials, and occurs with the lead ore in shallow horizontal openings. It was first utilized in 1871, prior to which time large amounts of it had been discovered and left in the ground or thrown aside. Since that time, it has been extensively mined, and has added greatly to the prosperity of the mines. Calamine is by nature less rich than blende in the proportion of 53 to 67 per cent; it is also much more difficult to clean when mixed with rock, on account of its lower specific gravity; but in proportion to the metal it contains, it is more valuable than blende, because it can be smelted more cheaply and the metal more perfectly extracted from it, and when mixed with blende in the furnace charge, it makes it possible to get more metal out of the blende. It is also valuable on account of the superior softness and toughness of the metal obtained from it; but it will not bear transportation to a distance as well as blende, on account of its lower percentage of metal. This ore has been at times the principal supply of the Carondelet Zinc Works; large amounts of it have been shipped to La Salle and Peru; and in 1874, 4,000 tons were shipped to Bethlehem, Pennsylvania, which yielded a little over 32 per cent of metal on the weight of the raw ore. It is less favored by the zinc works in the neighborhood, because the freight upon it is heavier than the freight on ore from other points, and because furnaces working it can not turn out as many pounds of metal a day as when working on blende, and the output of the works is reduced.

NOTES ON KANSAS MINERALS.

ERASMUS HAWORTH, EMPIRE CITY, KANSAS.

The following minerals, *new to Kansas*, have been found in Cherokee County:

1. Native sulphur. 2. Chalcopyrite (copper pyrites). 3. Greenockite (cadmium sulphide). 4. Anglesite (lead sulphate).

1. Native sulphur occurs at Weir City, and in other coal-mining districts.

The "dumps" at the coal shafts take fire spontaneously, and the heat decomposes a portion of the iron pyrites, the sulphur from which it is volatilized, and condenses at or near the surface of the dump-pile. Needle-shaped crystals, fully ⅔ c. m. in length, have been seen.

2. Chalcopyrite (copper pyrites) occurs in perfect tetrahedral crystals, which are generally—though not always—adhering to zinc blende. They vary in size from 1 mm. to ⅔ c. m. in thickness. It is quite common in three or four shafts in the Short Creek lead mines, and a few specimens of it have been obtained from Joplin, Missouri, although its occurrence at Joplin is not mentioned by Prof. Leonhard in his "Notes on the Minerals of Missouri."

3. Greenockite (cadmium sulphide) has been found in a number of different shafts in the Short Creek mines, occurring as a yellow, or yellowish green, incrustation. It gives to some brilliant sphalerite crystals a most beautiful appearance. No crystals have yet been found.

4. Anglesite (lead sulphate) is found adhering to galena. (Rare.)—*Proceedings Kansas Academy of Science.*

ANTHROPOLOGY.

THE TOOLS OF THE PYRAMID BUILDERS.

The arts and civilizations of the early Egyptians have furnished a theme to writers and travelers from the time of Moses downward, and scores of books have been written giving minute descriptions of the pyramids, the temples, the tombs, and the ruined cities that attest the wonderful progress of a people who, situated in a land of overflowing fertility, where the burden of procuring a livelihood was exceedingly light, were able to turn their energy into other channels, and more than 4000 years ago produced acievements that have never been rivaled. All this has been told and retold, but when we inquire how these architectural feats were performed, how the stone was quarried, transported, carved, and raised into its place, authors are silent, or else talk mysteriously about mechanical powers that have been lost, and the superiority of the ancients over us even in the matter in which we pride ourselves the most. The fact is that but few men who have studied Egyptology have been fitted by their previous training to investigate mechanical processes, or from a number of scattered fragments to arrive at the nature and the construction of the tools employed; and Egyptologists in general have been too fully occupied by the more seductive study of the language and social customs of the people to give any attention to these matters. Hence it is that, until quite recently, we have had but very vague ideas upon the means employed by the builders and masons of the pyramids. A recent investigator, however,—W. M. Flinders Petrie,—has brought a sudden accession to our stock of knowl-

edge, and by careful observation, and the collection of a number of samples, mostly half-finished articles damaged and rejected in manufacture, he has arrived at the most unexpected and startling conclusions that the hard stones employed by the Egyptians—the diorite, basalt and granite—were cut with jewel-pointed tools, used in the forms of straight and circular saws, solid and tubular drills, and graving tools, while the softer stones were picked, and brought to the true plane by the aid of trial or face plates.

Mr. Petrie has embodied the results of his novel and most interesting researches in a paper read before the Anthropological Institute; and on this we have drawn for the following account of the specimens and results, which will also be described in Mr. Petrie's forthcoming volume on "The Pyramids and Temples of Gizeh."

The first and most important point is that the principle of action of the tools was by plowing out the stone by fixed cutters, as in a planing machine, and not by grinding, as with a lapidary's wheel. The proofs of this are that the cut surfaces do not show a smooth ground surface as a stone sliced with diamond dust does, but a grooved surface, like free-stone cut by a toothed saw, or like rough-sawn timber; and that this grooving is not due to the action of any loose powder, is proved by the grooves being just as deep in hard stone (like quartz) as they are in softer stone, (like feldspar), when both occur side by side in the same specimen. Two examples of this grooving we illustrate here. The first (Fig. 1, one-

FIG. 1.

FIG. 2.

half actual size, as are all the illustrations of this article) is a core from a tube-drill hole in granite; on this, in one part, a continuous spiral of the lines of cutting may be traced for a length of three feet, passing five times around the core; and though, owing to rocking of the drill, it cannot be traced from end to end, yet no shallowing or widening of the grooves, indicating wear of the cutting point, can be seen in the course of the continous spiral. The second (Fig. 2)

shows the lines on basalt produced by the successive strokes of the saw; their regularity, both in depth and in distance apart, shows unmistakably that they are due to successive strokes of the cutting point, and not to any accidental or irregular causes. On other pieces of granite, diorite, basalt and limestone, similar marks may be found. A piece of diorite shows grooves $\frac{1}{100}$ inch deep, cut without any irregularity or starting of the tool; and a piece of the drill-hole in diorite shows seventeen equidistant grooves, probably equal to a cut twenty feet in length, without any appreciable difference in the groove from one end to the other. The fragments of diorite bowls with incised superscriptions which were picked up by Mr. Petrie at Gizeh show also the use of a graving point far harder than quartz, since the hieroglyphics are made by a cut with jagged edges, and not either scraped or ground. These are of the earliest period, as they bear the names of Semaferu and Khufu, the two oldest kings of whom any contemporary remains are known.

Considering these examples of work,—the definite grooves produced, their depths, continuity and equality throughout, the capacity of the cutting point for dealing with the hardest materials, and the rapidity with which the cutting was done, the tube-drills sinking $\frac{1}{10}$ inch in granite at every revolution,—it seems certain that no instrument but a metallic tool set with fixed jewel points could produce such results. The passage of the grooves without any interruption through the quartz, feldspar, hornblende, and mica of the red granite (as seen on the specimen in Fig. 1) is also a feature which shows brilliantly the capabilities of the tools, and the skill with which they were constructed. The strain on the cutting points in thus passing from a softer material into a patch of quartz would be enormous, far greater than if working continuously in quartz; and yet there is no starting, no burring, and no failure of the cutter.

If examples of work done by any grinding process be examined, it will be seen that there is not a trace of the definite grooves, such as are in the specimens alluded to. On modern lapidaries' work, done by a wheel fed with loose diamond powder, numerous shifts in the plane of the cut may be seen, showing the outline of the wheel; but no grooves or definite plowings in the material produced by individual points of diamond. Similarly in the tubular drillings done with soft iron and sand by the Chinese, or in similar work by other nations, there is never seen any trace of plowing-out of the material; and, indeed, it seems physically impossible that any particle of a loose powder could become so imbedded in a soft metal by the mere accident of rubbing, but it could bear the immense strain needed to plow out a groove of considerable depth in such a hard material as quartz; or make a groove passing continuously through hard and soft material without any interruption or differnce. The systematic use of jewel points set in some basis, may therefore be considered as proved by the existing work, and the fact that the loose sand left in a cut, and also the sides of some of the cuts are found to be stained green, leads to the conclusion that the metal of the setting was bronze.

What the jewels were is not yet known. The range of possible materials is limited to five minerals—beryl or emerald, topaz, chryso-beryl, sapphire and diamond. Experiments made with beryl and sapphire show that their edges will fail under far less pressure than is necessary to produce cuts such as above described. Some amorphous stone is needed, and it is only the scarcity of diamonds which makes us obliged to refer to corundum as a likely agent.

The forms of the tools were just such as our modern experience has led us to use in the present generation. Long straight saws, circular disc saws, solid drills, tubular drills, hand gravers, and lathe tools were all made on the principle of jewel points set in a metallic base, while hammer and chisel, pick, and hammer-dressing were also freely used where suitable. The straight saws were certainly as much as eight feet in length, as they cut a granite coffer seven feet six inches long from end to end. Their thickness varied from $\frac{2}{10}$ inch, as on large blocks of basalt, down to $\frac{1}{30}$ inch on a small syenite trinket. The principal examples of sawing are the granite coffer of the Great Pyramid, on which the saw has been twice run too deep, and on each side of which the grooves of the saw may be seen; the granite coffer of the Second Pyramid, where the saw has been run too deep on the bottom, though the marks are polished out elsewhere; and a great pavement of basalt one-third acre in area, containing some thousands of blocks, all sawn into form and finely fitted together. This last adjoins the Great Pyramid, and is probably coeval with it. A fragment from it is shown in Fig. 2. A hand specimen of sawing in grey syenite, picked up at Memphis, is here illustrated (Fig. 3). It is probably a piece of a statuary's waste, and is sawn on four sides, and has a cross cut also on the top.

Of circular saws we have but one evidence as yet; this is a slice of diorite, (Fig. 4), with the repeated circular sweeps so familiar to our eyes on steam-sawn

FIG. 3.

FIG. 4.

timber. These must have been produced by the successive revolutions of the most prominent cutting point at the side of a disc edge set with jewels; and though the surface has been polished sufficient traces of the lines remain to show their character, and to prove by their exact equality, uniformity of cut, and regular spacing apart, that they are not due to any casual or accidental cause. It has been suggested that the marks might have been produced by a series of points set on a flat rotating face for planing down the flat bottom of a dish; but beside the fact that no flat-bottomed dishes are known, and that the polishing lines cross the surface in all directions, it would need greater skill to set a row of stones on

a face so exactly to the same level as to make such marks than to set them on an edge for slicing. So the simplest explanation of the specimen is that a circular saw was used.

Though sawing was thus freely used for cutting the outsides of the great granite and basalt coffins, some other means was requisite for hollowing out the insides of such vessels. Here the inventive genius of the fourth dynasty exactly anticipated modern devices by adopting tubular drills, as the readiest and cleanest way of removing material with the least waste of force. These tubular drills varied much in diameter, thickness, and length. Those in softer materials, as alabaster, were smaller and thinner, not needing to carry set stones on the edge, but being merely worked with powder. But the larger ones used for hollowing out granite on a large scale, were usually about four inches in diameter. One of the finest examples (about two inches in diameter) is in the pivot-hole of a door in a lintel of the granite temple at Gizeh, built by the king of the Second Pyramid, Khafra. This is shown here, (Fig. 5,) drawn from a cast which Mr. Petrie obtained by means of a gutta-percha mould. Here it will be seen that the core could not be broken out entirely, owing to its running into a tough patch of horn-blende.

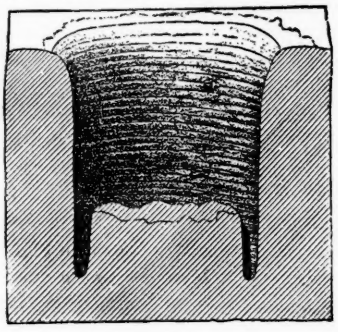

FIG. 5.

The granite-core already described, (Fig. 1) is also a fine illustration of tubular drill work, and would be considered a creditable result by modern men using modern tools. The various examples of such drilling that have been found, mainly at Gizeh, may be tabulated thus:

DIAMETER.	MATERIAL.	
.24	Alabaster	Tube .02 thick (Fig. 6): others up to.
.7	"	Tube .04 thick.
1.8	Basalt	A hole in a vase.
1.9	Limestone	A core.
2.2	Granite	Tube .1 thick (Fig. 5).
2.5	Alabaster	A core.
2.8	"	A core.
4.2	Granite	Inside of Great Pyramid coffer.
4.5	Greenstone	Fragment of waste.
4.8	Limestone	Two holes joined (Fig. 7).
4.8	Diorite	
18 about	Limestone	Rock dressing.

Of these the holes inside the Great Pyramid coffer show the length of drill used, as

they end about eight inches below the top. The holes in limestone show how closely they are placed together for hollowing out material; and the holes were all skillfully spaced so that each annular groove of the tool overlapped and used as much as possible of the cut next to to it, so as to economize labor to the utmost. The rock-dressing at El Bersheh shows apparently

FIG. 6.

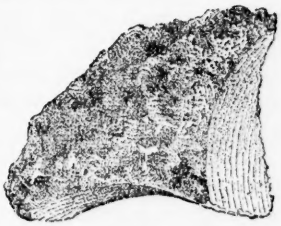

FIG. 7.

the use of large tubular drills for clearing away masses of rock, the surface of a large excavated platform being covered with circular grooves, smooth around their bottoms as if produced by a continuous cut, and not by chisel work, and just joining one another. This could not be the result of cutting out columns, as the rock surface is rough-broken both within and outside of the smooth grooves, and the grooves sometimes intersect. This work is probably of the twelfth dynasty, or about 2000 B. C.; and hence later than the pyramid work, which is the principal subject of examination in the present inquiry.

Hence it seems almost certain that the tubular drill principle, of which exam ples are here described from one-quarter of an inch to nearly 5 inches in diameter, was carried still further into sizes suitable for removing rock on a large scale; sizes which must have needed several men to turn the capstan head of the drill. Many other traces of the use of tubular drills were mentioned, as, for instance, in roughing out statues, but more particularly for beginning the hollowing of the insides of vases and bowls, which were afterward finished in the lathe.

A peculiar feature of the cores and holes made by the tubular drills is a certain amount of tapering, which is always to be found. This tapering cannot have been produced by the rubbing of the side of the drill in turning round in the hole, since not only would such a cause be quite inadepuate, but the grooves plowed out by the cutting points are just as distinct on the sides of the tube or core where it is tapered, as on the lower part. Hence it seems that not only did the Egyptians set cutting jewels round the edge of the drill tube, as in modern diamond crown drills, but they also set them in the sides of the tube, both inside and out Thus the hole was continually reamed larger by the tool, and the core turned down smaller as the cutting proceeded, and so the tool could be withdrawn more readily from the groove, as the annular space was thus wider at the top than at the bottom. Other drills, not tubular, were used for very small holes, such as those in the symbolic eyes, which are drilled in syenite, 1.2 inches long, and only 0.08 inch in diameter.

Experiments made by the author seem to show that the minimum pressure upon a four-inch drill could not be less than half a ton, and was probably two tons, and this is amply confirmed by the speed at which the tool is seen to have advanced, and is in accordance with the experience of modern engineers. Upon

the granite core (Fig. 1) the grooves are a double spiral, showing that they were made by two stones at opposite sides of the tubes; the pitch of the thread is $\frac{1}{10}$ inch, the circumference of the core about 7 inches, and therefore the rate of sinking was $\frac{1}{70}$ of the distance traveled by the tool. The wonder is how any bronze tube or saw blade could bear the requisite pressure without doubling up, and how the jewels could be set in sockets to support them against such a violent drag.

Not only was a rotating tool employed, but the further idea of rotating the work and fixing the tool was also familiar to the earliest Egyptians. This is evidenced by the fragments of bowls turned in diorite. One piece of the bottom of a bowl (Fig. 8) shows the characterized marks of the turning. Not only are there the circular grooves of the jewel pointed tool, but also the marks of two different centerings, showing that the work had been displaced by the force applied in turning, and afterward reset, but not accurately, the old and new surfaces meeting in a cusp. Other specimens of turning in black granite, basalt, and alabaster, all of the pyramid period, were exhibited by the author. The finest examples of turning in hard stone, however, are in the British Museum. Among these are a small, highly-polished, narrow-necked vase in diorite, or rather in transparent quartz with horn-blende, which has its neck only 0.05 inch thick, and a large vase of syenite turned inside and out remarkably thin considering the size of the component crystals. But the greatest triumph is a bowl of diorite, translucent and full of minute flaws, which must render it very brittle; yet this bowl, six inches in diameter, is only $\frac{1}{40}$ of an inch thick (.024) over its greatest part; just around the edge it is thicker, but a small piece broken out of the body of it shows its extraordinary thiness, no stouter than a thin card. An

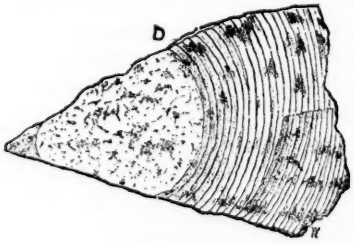

FIG. 8.

FIG. 9.

alabaster vase of Unas of the fifth dynasty, almost rivals this in thinness, being only $\frac{1}{25}$ inch to $\frac{1}{30}$ inch thick, but the softness of the material makes it of far less interest. A very favorite plan for narrow necked vessels was to turn them in two or three parts and join these together, sometimes finishing off the inside on a fresh centering of the lathe. One example shows that the early Egyptians were familiar, not only with jewelled turning tools, but with mechanical tool rests, and with sweeping regular arcs in cutting. A fragment of a diorite bowl (Fig. 9) shows that the original article was turned as a segment of a sphere inside by a

tool working from a fixed center in the the axis of the lathe, with a radius of 3.94 inches. Having cut this spherical curve, the center of play of the tool was shifted about .5 inches higher, and .7 inches out of the lathe axis, and a fresh arc on the bowl was struck from this centre, thereby cutting out a fresh curve which left a raised lip around the edges. The proofs of this explanation of the process are found in the exact equality of the two curves,—that of the bowl in general and that under the lip,—in the fact of the principal surface exactly coinciding with the inner edge of the lip, in the fact of the circularity of the section curves, and in the cusp formed where they meet, an awkwardness which no hand-turner would ever take the trouble to make, but which necessarily results from a sudden change in the centre of the arc of the tool. All these details have been worked out by the author from very careful measurements of the fragment, using successive templates of slightly varying radius to measure the exact curvature, etc.

In addition to the tools we have already described, graving instruments were employed in the production of intricate forms. Blocks of stones were likewise hammer-dressed; sometimes saw nicks were cut one-half an inch deep round a block; and then the hammer-dresser was left to work the surface down to the plane of the grooves. Also on sawn blocks the surface to be placed in contact was usually hammer-dressed to have sufficient space to hold the cement, while the edges were left quite smooth. For dressing surfaces to a true level, the regular custom of the workmen was to use a trial or face-plate prepared as a true plane and smeared with red ochre; wherever the ochre came off on the stone they knew there was an excess and accordingly dressed it off. The tool used appears to have been a sort of small adze, with which the stone was sliced down very delicately and regularly by hand. All the blocks of the Great Pyramid casing were prepared with these facing plates, as may be seen by the remaining touches of ochre on the prominent points. Not only on building stones, but also on rock-dressing the same ochreing is visible. Where the stone was much larger than the facing plate, as was the block of granite over the king's chamber doorway, about 8x12 feet, then a diagonal draft was cut along the stone from corner to corner, and thus any wind in the plane of the face was avoided. In a painting at Thebes the workmen are apparently shown chiseling down a stone to a plane face; they have a string stretched quite clear of a stone over an offset block at each side, and are then applying an offset piece to the face of the stone to see whether the face is in excess. This is a skillful method of working, as the excess does not bulge out the string, and can be exactly measured as they proceed, while the string does not need to be removed, as the chisel can be used under it. Working on a vertical face, the beveling of the string does not affect it.

This completes the list of Egyptian tools dealt with by Mr. Petrie, but he adds many interesting details of the methods of building and quarrying, which, however, we can hardly notice as fully as the tools, since they do not present so great a novelty. The centre line of passages and stone blocks were carefully marked in red to guide workmen, and reference marks were added in case the

first grew illegible or were covered up. In the rough courses of the mass of masonry of the pyramids the irregularities of the stones of one course were let into the course below them; thus each course bears on it a sort of plan, sunk to different levels, showing the stones that came above it. The method of fine dressing all the limestone was by carefully picking, as if with a small adze, and the standard of flatness appears to have been that no more than a couple of inches across should miss touching the true plane within the thickness of the smear of ochre. The method of quarrying the limstone was by driving galleries into the hillside and taking out a stratum of stone, leaving the hill standing above on the support of pillars. The manner of raising the blocks is not known except by inference, and that points to rocking them and packing them up on two piles of timber near the centre, but this does not afford a satisfactory explanation of the way in which some of the stones were got into place. For instance, the lower granite portcullis of the Second Pyramid, a block that would need forty to sixty men to lift it, was slid on its edge along a passage only three and a half feet wide, and then slewed round in a complex way to turn it up into the grooves prepared in the rock for it to slide in. Not more than four men could well work at it, and these in a cramped space; hence some great advantage of leverage skillfully applied must have been available.

These investigations of the mechanical methods employed by the pyramid builders are but a small portion of the researches carried on by Mr. Petrie during two winters' residence in a tomb at Gizeh. The main object of this work was the accurate surveying of the pyramids with instruments of first-class precision, the results being obtained to within one or two tenths of an inch over ground, half a mile across, by means of an extensive and closely-checked triangulation. We hear that the Royal Sosety have recognized the value of the work by giving a grant for its publication, from the Government grant for research, and we may soon expect to have a full account of the instruments employed, the measurements obtained. and the bearing of these on the various theories of the pyramids, besides various historical and architectural notes, and a discussion of new methods in the mathematical treatment of observations.—*Engineering.*

EARLY MAN IN AMERICA.

W. BOYD DAWKINS.

Who were the earliest inhabitant of America, and when did they live? are questions which have generally been approached solely from the point of view offered by discoveries in the United States, and, until within the last three or four years, have been discussed only on the slender basis of the Calaveras skull and the implements found in gold-mining in California. In the following essay I propose to deal with them as portions of the great problem common to the Old and New Worlds, and to show that the first traces of man, as yet discovered, prove him to have lived in the same low stage of culture on both sides of the

Atlantic, at a time when the hands of the geological clock pointed to the same hour over the greater part of the world. The story of early man in America is a part of the greater story of the first appearance of man on the earth, so far as he has yet been revealed by modern discovery.

Before we enter into these questions, we must define clearly what is meant by the geological clock. * * * * * *

The change in life has been so regular, definite, and orderly in the geological past, that it enables us to classify the rocks over the whole world into Primary, Secondary, and Tertiary groups. In the last of these, the higher types of Mammalia become more and more specialized as we draw nearer to the frontiers of history; and their pedigrees, when traced from one period to another, assume the shape of genealogical trees, such as that which Professor Marsh has discovered for the horse. The living orders first appear in the Eocene, the living genera in the Miocene, a few living species in the Pliocene, while nearly all the living species come into the Pleistocene division. Again, in the interval dividing the last from the Historic period, the domestic animals appear and the cultivated fruits, and this—the Prehistoric—gradually passes into the period embraced by the written records. The succession of events may be used as the figures on our dial-plate, marking the lapse of geological time in the Tertiary period, as follows: (1). The Eocene period, in which the placental mammals now on the earth were represented by extinct allied forms belonging to existing families and orders. The order Primates, to which man belongs, is represented by creatures allied to the lemurs both in the Old and New World. (2). The Miocene, in which the alliance between living and extinct mammals is more close, and living genera appear. The Primates are represented by a higher division, the family of apes, in Europe and in the United States. (3). The Pliocene, in which, for the first time, living mammalian species appear; but they are few in number compared with the extinct species. (4). The Pleistocene, in which the living species are more abundant than the extinct among the Mammalia, and the Primates are represented by their highest development, the family of man. (5). The Prehistoric, characterized by the present fauna and flora, being in possession of the regions in which they have been known historically. Man has increased and multiplied on the earth, and is possessed of domesticated animals and cultivated fruits, and has acquired the arts of spinning, weaving, mining, and pottery-making in the Old World, and gradually passed through the Neolithic, Bronze and Iron stages of civilization. (6). The Historic, or period covered by written records, which varies in each country, going back to 4000 B. C. in Egypt, and in America to the time of Christopher Columbus. Were the extinct species taken into account, it would be seen that they fill up the interval separating one living form from another, and that they approximate to living species as they approach nearer to the present time.

It will be seen from the examination of the above periods that the inquiry into the antiquity of man is limited to the last four. The most highly specialized form in the animal kingdom cannot be looked for until the lower animals by

which he is now surrounded made their appearance. We cannot imagine him to have been living in the Eocene age, when animal life was not sufficiently differentiated to present us with living genera of placental mammals. Nor is there any probability of his having appeared on the earth in the Miocene, because of the absence of placental mammals belonging to living species. It is most unlikely that man should appear in a fauna in which there was no other living mammal. He belongs to a more advanced stage of evolution than that presented by the mid-Miocene of Thenay, in which flint splinters fashioned by man are said to have occurred. Up to this time, the evolution of the animal kingdom had advanced no farther than the *Simiadæ* in the direction of man, and the apes then haunting the forests of Italy, France and Germany were the most highly organized types. We may also look at the question from another point of view. If man were upon the earth in the Miocene age, it is incredible that he should not have become something else while those changes were going on in the conditions of life by which all the Miocene land mammalia have been so profoundly affected that they have either assumed new forms or been exterminated. It is impossible to believe that man should have been an exception to the law of change. Nor in the succeeding Pliocene age can we expect to find traces of man upon the earth. The living placental mammals had only then begun to appear, and seeing that the higher animals have invariably appeared in the rocks according to their place in the zoöological scale, Fishes, Amphibians, Reptiles, Placental Mammals, it is hardly reasonable to suppose that the highest of all should then have been upon the earth. The few scored bones in the Pliocene strata of Italy, referred by Prof. Capelini to the work of Pliocene man, are considered by Evans and Mortillet to have been marked by the teeth of the large sharks abundant in those seas. and if they be artificial it is not, in my opinion, proved that they were marked in the Pliocene age. "The fossil man of Denise" is of uncertain age, and other alleged cases of Pliocene man in Europe have now been given up.

The question has however been revived in the United States by Prof. Whitney, in his work on the Auriferous Gravels of California, and the existence of man in California, in the Pliocene age, has been accepted by such high authorities as Marsh, LeConte, and others. It becomes, therefore, necessary for us to see how the facts will stand the test of criticism. In the first place it is assumed that the auriferous gravels in the Sierras, with traces of man, which are in some places three hundred feet thick, and sometimes covered with ancient lava streams, are of Pliocene age. They are, however, proved by their fossils, identified by Dr. Leidy, to have been deposited by the streams from the Miocene (*Elotherium*) age down to the present time. Among the animals we may note the skull of a mustang, identical with that of Mexico and California, which could not have been buried in the gravels of Sierra County before the time of the Spanish conquest, when the living race of horses was introduced. Consequently, the discovery of human remains in the auriferous gravels does not prove that man was an inhabitant of Pliocene America, even if it be allowed that they are of the same age as the strata in which they lie. There is, however, no evidence of this in any one instance.

The objects themselves point to a directly opposite conclusion. The stone mortars, pestles, polished stone axes, beads, etc., found at various depths, are identical with those scattered over the surface, and used by the Indian tribes of California, described by Bancroft in his "Native Races of the Pacific States," and more recently by various writers in the seventh volume of the United States Geographical Survey under the direction of Captain Wheeler. The human bones are indistinguishable from those of the Red Indians. The famous Calaveras skull, according to Prof. Wyman, is related to the Indian type, with a doubtful affinity with the Eskimos. It was obtained from a shaft sunk through three alternate layers of gravel and basalt, at a depth of one hundred and thirty-two feet from the surface, was associated with the remains of other individuals, and had been buried along with shell-beads of the kind usually met with in Indian interments. Had these remains been found near the surface they would have been undoubtedly classified with the ordinary traces of Indians, and their occurrence at so great a depth is the sole cause of their being the object of special interest.

Nor have we to go far to account for their presence at great depths. It is very strange that Prof. Whitney should have ignored the fact that mining operations have been carried on in those very districts long before the time of "the forties." "In 1849," writes Schoolcraft ("Archæology," Vol. I, p. 105), "the gold-diggers at one of the mountain diggings, called Murphy's, were surprised, in examining a high, barren district of mountain, to find an old site of a mine, with a shaft two hundred and ten feet deep, at the bottom of which were a human skeleton, an 'altar,' and other remains of an ancient people,—probably Indian." In other ancient mines in the Western States, as Dr. Southall has recently pointed out, human skeletons have been met with, which prove that gold mining was extensively carried on long before the discovery of gold in the present century. The whole group of human remains, therefore, in the auriferous deposits, instead of proving the existence of Red Indians in California in the Pliocene age, belong to a comparatively modern period. Some are probably the results of interments which took place in deep mines or in superficial deposits, while others have found their way by accident into the auriferous gravels from the surface at various times. * * * * *

The remains, looked at purely from the archæological point of view, are Neolithic, and identical with those which unmistakably belong to the ancient Indian tribes of North America. We cannot seriously entertain the idea that mankind first appeared on the earth in the Neolithic stage of culture, identical, so far as we know, in every respect with the ancestors of the present Red Indians, at a time when there were but few living species of the higher mammalia, and that he lived in California before cañons from two to three thousand feet had been cut by the existing streams out of the solid rock. Neither in the New nor in the Old World is there any trace of Pliocene man revealed by modern discovery.

We come now in our inquiry to the succeeding period, when the higher Mammalia, now contemporary with man, appeared in force on the earth, and man himself may be reasonably looked for. We will take the point of view, first

of all, offered by Europe. The Pleistocene, or Quaternary, period in Europe is characterised by the arrival of numerous living species, which are divisible into four natural groups, according to their present *habitats*. To the first belong those now living in the temperate zone in the northern hemisphere, such as the mole, musk-shrew, beaver, lynx, wild-cat, wolf, fox, martin, ermine, stoat, otter, brown and grizzly bear, horse, bison, urus, saiga antelope, stag, roe, fallow-deer, and wild boar. They emigrated from Asia, and some pushed their way as far south as northern Africa. The second consists of arctic animals, such as the arctic hare and lemming, musk-sheep, reindeer, and wolverine. These animals also came from Asia, and found their way as far to the south as the Alps and Pyrenees, and as far to the west as Ireland. The third group is composed of those animals now enjoying the cold climate of high altitudes in Europe, such as the chamois, ibex, and Alpine marmot. The fourth is represented by animals now only found in warm countries, such as the lion, panther, African lynx, spotted and striped hyena, hippopotamus, and African elephant and porcupine. The remains of these animals lie scattered over southern Europe, and as far to the north as Yorkshire, and to the west as Ireland. With these, certain extinct species appear, hitherto unknown, such as the straight-tusked elephant, mammoth, pigmy elephant, woolly and small-nosed rhinoceros, the Irish elk, pigmy hippopotamus, and the cave-bear.

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Owing to these climatal changes every inch of ground, in middle and western Europe, would successively form a frontier between the northern and southern animals, and their remains would be mingled together as we find them to be. During the extreme cold, the arctic animals would arrive at their southern limit. Closely following on this lowering of the temperature to its minimum, geographical changes of great magnitude took place in the north of Europe. The area to the north of the line passing from the lower valley of the Severn eastward into Russia was depressed beneath the waves of a berg-laden sea, and again lifted up so that the British Isles, then an archipelago, again formed part of the main land. As the land emerged from the water, the Pleistocene forests crept over it, and the animals found their way over the southern and midland counties.

Such as this was the scene on which man first appears in Europe. Rude splinters of stone, and roughly chipped pebbles of flint and chert, at their very best trimmed to an almond shape, and mostly intended for use in the hand, occur abundantly in the river deposits of England and France, in association with the remains of the above animals. They are the implements of savages living by the chase, and probably also by fishing and fowling. Not only have the implements been discovered, but the very spots on the river-bank where the hunter sat and made them have been identified, as at Crayford and other places in the valley of the Thames. Could we have penetrated to the banks of the Thames, or of the Seine in those times, guided by a thin column of smoke rising over the trees till we reached the camp ot the river-drift hunter, we might have seen the men selecting blocks of flint and chipping their implements out of them, the women

preparing the half raw meal of flesh, it may be of reindeer, mammoth, or rhinoceros, while the children broke the silence of the evening with their shouts on those very spots where are now to be heard, day and night, the voices of London and Paris.

Nor can there be much doubt as to the relation of the river-drift hunter to the above mentioned changes in climate and geography, which are usually summed up under the term Glacial. The balance of evidence is in favor of the view that the hunter at Crayford was in the valley of the Thames before the submergence, and before the temperature had reached its minimum, or in other words, in Preglacial times. The river-drift hunter whose implements are left at Abbeville traversed the shore of a berg-laden sea, and possibly may have inherited a tradition from his ancestors of the famous hunting-grounds then lying at the bottom of the British Channel and the great Northern Ocean. The hunter who followed the hippopotamus and the reindeer in the valley of the Ouse, near Bedford, was there after the re-elevation of the land and the cutting of the valley through the mantle of boulder clay which had been dropped from the melting bergs. He probably went far enough northward to see the glaciers then crowning the Pennine chain and the mountainous regions of Wales.

Southward, the river-drift man wandered far and wide over France, hunting the same animals in the valleys of the Rhone, Loire, and Garonne as in the Valley of the Thames. In the Iberian Peninsula he was a contemporary of the African elephant, the mammoth, and the straight-tusked elephant, and he camped in the neighborhood both of Lisbon and Madrid, showing here, as in France and Britain, singular facility in choosing places, which became, in the long ages which were to follow, the sites of great capitals. He also ranged over Italy, leaving his implements behind in the Abruzzo; and in Greece, in the neighborhood of Corinth, he was familiar with the extinct pigmy hippopotamus. We can also track him south of the Mediterranean by the implements found in Oran, and near Kolea in Algeria, in the Sahara, and in several places in Egypt. At Luxor, they have been discovered by General Pitt Rivers in the breccia, out of which are hewn the tombs of the Egyptian kings. In Palestine, they have been obtained by the Abbé Richard between Mount Tabor and the Sea of Tiberias, and by Mr. Stopes between Jerusalem and Bethlehem. Throughout this wide area the implements are of the same rude type, and generally of the same materials, flint or quartzite, those of Luxor and Palestine being identical with those in the river valleys of Britain and of France. Throughout this area, too, the river-drift man hunted some or other of those animals which we have mentioned above.

Nor is our survey yet ended. He is proved by many discoveries to have ranged over the Indian peninsula, from the valley of the Nerbudda in the north as far as Madras. Here we find him forming part of a fauna in which are to be numbered species now living in India, such as the Indian rhinoceros and the arnee, as well as extinct types of oxen and elephants. There were two extinct hippopotami in the rivers, as well as living gavials, turtles, and tortoises. It is plain, therefore, that at this time the higher mammals of India stood in the same

relation to the present Indian animals as the European fauna of the Pleistocene does to that now living in Europe. In both there was a similar association of living with extinct forms, and in both the central figure is the river-drift hunter.

We are led from the region of tropical India to the banks of the Delaware in New Jersey, by the recent discoveries of Dr. Abbott, in the neighborhood of Trenton, which I have had the opportunity of examining with that gentleman and Professors Haynes and Lewis. The implements are of the same type, and occur under exactly the same conditions as the river-drift implements of Europe. They are found in a terrace of river gravel and loam overlooking the river, and are composed of materials derived from the old terminal moraine which strikes acoss the States of New Jersey and Pennsylvania in the direction of Lake Erie. The large blocks of stone which it contains indicate that during the time of its accumulation there were ice rafts floating down the Delaware in the spring, as in the Thames, the Seine, and the Somme in those days. According to Professor Lewis, it was formed either during the time when the glacier of the Delaware was retreating ("Late Glacial") or a latter period ("Post-Glacial"). The physical evidence is clear that it belongs to the same age as the deposits with similar remains in Europe. The fossil animals—the reindeer, bison, and mastodon—found in it also point to the same conclusion. These animals belong to a fauna occurring in fluviatile deposits in North America, composed of the same elements, and even some of the same species (as may be seen in Dr. Leidy's lists) as that of the Pleistocenes of Europe. In it living and extinct forms, and those now found in warm and cold regions, were mingled together. To the temperate division belong the Virginian deer, the bison, raccoon, and the stag, the beaver and the elk; to the northern, the reindeer and musk-sheep; to the southern, the tapir and peccary. Among the extinct species we may note the American variety of the mammoth, the mastodon, and the great sloths—*Megatherium*, *Megalonyx*, and *Mylodon*, as well as a species of capybara and of musk-sheep. The *Felis atrox* of Dr. Leidy I am unable to distinguish from the cave-lion of Europe. All these animals were probably familiar to the river-drift hunter as he passed northward to the edge of the great glacier, or southward into the tropics of Central America. He was encamped at Trenton either while New York lay buried under the ice—which has left its unmistakable marks in the smoothed rocks of the Central Park—or while that ice was melting away. Thus, in our survey of the conditions of life when man first appeared in Europe, India, and North America, we see that the animal life was in the same stage of evolution, and that "the old order" was yielding place "unto the new" in these three regions so widely removed from each other. The river-drift hunter is proved by his surroundings to belong to the Pleistocene age in all three.

It remains for us to weave the scattered threads of the inquiry in general conclusions. The identity of the implements proves that the river-drift hunter was in the same rude state of civilization, if it can be called civilization, in the Old and New Worlds, while the hand of the geological clock pointed to the same hour. It is not a little strange that his mode of life should have been the same

in the lands bordering on the Mediterranean, in the tropical forests of India, and on both sides of the Atlantic. The hunter of the reindeer in the valley of the Delaware was the same kind of savage as the hunter of the reindeer on the banks of the Thames or the Seine. It does not, however, follow that this indentity of implements implies that the same race of men ranged over this vast tract. While this may be left an open question, it certainly indicates a primeval condition of savagery, from which mankind has emerged in the long ages that separate it from our own time. We may also infer from his wide range that the river-drift hunter (assuming that mankind sprang from one center) inhabited the earth for a long time, and that his dispersal took place before the glacial submergence and the lowering of the temperature in northern Europe, Asia, and America. It is not reasonable to suppose that the Straits of Behring could have offered a free passage either to the river-drift man migrating from Asia to America, or to the American animals from America to Europe, while there was a great barrier of ice, or of sea, or of both, in the high northern latitudes.

It will be naturally asked who and what was the river-drift hunter. The question can only be partially answered in the present stage of the inquiry. The few fragments of human bones, beyond doubt associated with the implements, are too imperfect to offer any evidence as to race. They, however, point out unmistakably that he was a man, and not "a missing link," and that he was without traces of Simian ancestry, such as have been ascribed to him by Mortillet and others. On this important point I entirely agree with Dr. Virchow. The river-drift man has vanished from the face of the earth without leaving any clew to his identification with any living race. After him the race of the cave-men appeared in Europe, now represented by the Eskimos.

We may realize before the rock-hewn tombs at Luxor the impossibility of measuring the date of the river-drift hunter in terms of years. In the interval between the time of his encampment on the site of ancient Thebes and the rise of the splendor of Egypt, the conditions of life described in the preceding pages passed away, and man had progressed from the hunter stage of civilization into that of the Neolithic, of the Bronze, and of the Iron ages. He stands on the other side of an abyss of past time, the depth of which has not been, and which in my opinion cannot be, fathomed.—*North American Review, October, 1883.*

MASTODON BONES FOUND AT CHESTER, ILL.

Messrs. Mitchell & Needles, the contractors of the Penitentiary brick-works, are getting their clay from the hill back of the prison buildings and about 150 feet above the river. For some time they have been taking out immense bones, teeth and jaw-bones, etc., but recently a mastodon's tusk and head was uncovered at a depth of fifteen feet. The tusk is or was a most beautiful and perfect specimen, all complete, without a flaw in it. The root of the tusk was slightly flat on the under side and measured exactly 8 inches in diameter: in the center it measured 6½ inches, and its total length is 5 feet 6 inches. The head is an immense affair, but as yet is not entirely exhumed, and will not be until Prof. A. H. Worthing, of Springfield, Ill., arrives to take care of it. There is everything to indicate that there is more than one mastodon, as a few days ago a much smaller tusk was found.

ASTRONOMY.

THE CORONA.

EDGAR L. LARKIN.

Of late, there seems to have been a reversal in scientific opinion regarding the coronal light seen around the Sun when eclipsed. Research made by American astronomers stationed on Caroline Islands, South Pacific, on the total solar eclipse May 6, 1883, led to the change in current beliefs. The discoveries of Professors Hasting, Holden and Rockwell appear to decide that the corona instead of being a solar appendage, is simply a diffraction phenomenon.

The preliminary report of Prof. Hasting in the Baltimore *Sun*; the partial report of Prof. Holden made at American Association for the Advancement of Science, Minneapolis, at its recent session, and a conversation with Astronomer Rockwell, at Minneapolis, fully convinced me that the corona is in no way connected with the Sun. The difficulties in the way of such conclusion have always been formidable, for if the corona is solar, then the pressure on the Sun's surface would be far greater than the spectroscope shows to exist. By experimenting with Geissler's tubes, it was discovered that difference in pressures of gases wrought changes in their spectra. Geissler's tubes are made of glass, and have apertures through which they can be filled or emptied by a Sprengel pump. Each tube has a platinum wire burned through either end so that when the wires are attached to the poles of a battery, electric sparks pass from one wire to the other through the length of the tube. Suppose it is desired to watch the changes in hydrogen spectra developed by different pressures; all that is needed is to force more hydrogen into the tube when the electric sparks are traversing the space between the platinum terminals.

Then we read in Lockyer's Star-Gazing, p. 414,—"We shall find the color of the gas through which the spark passes, varies considerably as we increase the pressure of the hydrogen in the tube. The hydrogen at starting is nearly as rare as it can be, and if more hydrogen be let in we shall see a change of color from greenish white to red, the hydrogen admitted has increased the pressure and the color of the spark is entirely changed. It is of a very brilliant red color, the color of the prominences round the Sun."

From this, we see that red appears when pressure on hydrogen is no greater than can be resisted by a thin shell of glass; a pressure about that exerted by the atmosphere of the earth. We have proof, then, that hydrogen composing the solar protuberances does not exist under abnormal compression,—proof derived from color. That is, it is not necessary that hydrogen be subjected to a greater

pressure than fifteen pounds to a square inch in order that it may emit a vivid red light when subjected to the action of electricity.

Confirmation of the idea that excessive pressure does not exist on the Sun's surface from superposed gases, is available from another fact in spectroscopy. In Lockyer's Star-Gazing, pp. 416–17, may be found a complete description of spectra of compressed or of abundant gases. The main fact brought out is that the greater the density or what is the same, the greater the pressure on the vapor of a metal, the more complex—that is, having more lines—is its spectrum. Experiment was made, p. 416, with the electric spark between magnesium wires; when spectral lines were found of unequal length. The explanation offered is that the vapor of the magnesium had different densities in the ratio of distances from the wires. The denser layers of vapor gave three lines, the next dense two, while the outside or layer of at least density gave only one line in the spectrum. We quote p. 417, "Of late, experiments have been made in England on other metals—for instance, aluminium and zinc, and their compounds; and it is found that, when the vapor is diluted, as it were, one gets only the longest line or lines; and in the compounds, where the bands due to the compound compose the chief part of the spectrum, the longest line or lines of the metal only appear. Now what is the application of this? In the Sun are found some of the dark lines of certain metals, but not all; for instance, there are two lines in the solar spectrum corresponding to zinc, but there are twenty-seven bright lines from the metal when volatilized by the electric spark. Why should not these also have their corresponding dark lines in the Sun? The answer is, that the non-corresponding lines of the metal are the short ones, and only exist close to the metal where the vapor is dense; and in the Sun the density is not sufficient to give these lines." Surely the pressure of gases on the Sun cannot be enormous, else more than two of twenty-seven lines of zinc could be detected. Prof. C. A. Young, The Sun, p. 237, says: "Every one now, we think, admits the presence of an atmosphere of incandescent gases reaching to an elevation of at least 300,000 miles, and this although there are enormous difficulties in harmonizing an atmosphere of such extent with the low pressure at the surface of the photosphere, indicated by the fineness of the Fraunhofer lines in the spectrum." It is well known that revelations of the spectroscope are to the effect that pressure on the surface of the Sun is low.

Prof. Hasting's informal report as printed in the Baltimore *Sun* reads: "It is known from study of the Sun that gaseous pressure at the surface must be less than an inch of mercury, and is probably less than one-tenth of an inch." These quotations from eminent physicists indicate that there is either no corona, or that it is of very little importance in cosmical physics. But then, this appendage has been seen at enormous distances in all directions from the solar limb. Thus: Newcomb and Holden's Astronomy, p. 299, says: "The total phase lasts for a few minutes (never more than six or seven), and during this time, as the eye becomes more and more accustomed to the light, the outer corona is seen to stretch further and further away from the Sun's limb. At the eclipse of 1878,

July 29th, it was seen by Professor Langley, and by one of the writers, to extend more than 6° (about 9,000,000 miles) from the Sun's limb.

Now what shall be said of this fact where as we have seen before, that the pressure of the superincumbent gases on the Sun, is only one-tenth of an inch of mercury?

The pressure of the terrestial atmosphere is thirty inches; and should the air suddenly become hydrogen, then the pressure would still be two inches! The force of gravity on the earth's surface is equal to 1, and on the Sun's surface it is equal to 27.8365, whence a depth of hydrogen on the Sun, no greater than that of the air on the Earth would press with an intensity of fifty-five inches of quick-silver! How, then, account for the low pressure known to exist on the exterior of the Sun?

Is there an unknown force of repulsion whose laws are still a mystery? Or, is the heat developed by the chemism of the Sun, an ample repulsive energy? Or, really is there no such thing as a mass of gas around the solar globe? If the gas is nine million, or even one million miles deep, it seems incredible that the total repulsion exerted by the heat or any other mode of force on the Sun should be able to so nearly counteract the colossal power of gravity that a column of mercury—assumed cold—would subside to one-tenth of an inch or an inch.

Astronomers are wrong concerning the co-efficient of pressure on the Sun, else there is no corona; or being right in both of these, then, there exists on the Sun an energy of repulsion, whose laws are wholly unknown to science. Or, perhaps repulsive force evolved from thermal or electrical modes of energy accounts for the slight pressure.

Speaking of the Eclipse Expedition the Baltimore *Sun* relates: "When the Moon covers the Sun an envelope of light is seen all around it; the envelope is not visible, when the Sun is shining, on account of the Sun's greater brightness; this light is called the corona. * * * The opinion has been that this light was due to an atmosphere extending for millions of miles from the Sun. According to Dr. Hasting's view it must be light from the Sun which has undergone refraction, *i. e.*, has been bent from its regular course by the interposition of an opaque body like the Moon."

The plan adopted was to place prisms in the tele-spectroscope tangent to the limbs of the Sun, in an arrangement so that both sides of the Sun could be seen at one view side by side. If the corona is a solar appendage the slight motion of the Moon, ought not to work many change in the lines of its spectra as seen from both sides of the Sun. But if the corona is a diffraction phenomenon caused in the Earth's atmosphere by light refracted by the Moon's edge, then as the Moon moves, the spectral lines should change. That is, the lines should make changes in relative length when caused by light reaching the spectroscope from the west on east sides of the solar orb.

We quote from Prof. E. S. Holden's report made at Minneapolis, and published in *Science*, August issue. "With the spectroscope, the chief point of observation was as to the relative lengths of the line 1474 east and west of the

Sun. At second contact, this line was 12′ longitude east and 3′ west. The length of 1474 east diminished, while 1474 west increased. At mid totality these were equal. Before the third contact, the appearances were reversed; 1474 west was longer and brighter than 1474 east." The results of the observation coincided with previous computations made by Dr. Hastings, whose calculations were based on the mathematical laws developed by the wave theory of propagation of light.

The expedition gives two results most valuable to science. It aids us dispel belief in the existence of a corona around the Sun, besides serving to remove this barrier which has so long stood in the way of comprehension of solar physics; and lends confirmation to the undulatory theory of light, since computations made by means of its laws were verified. If it shall be demonstrated that there is no corona,—matters will be much less complex in solar studies; no unknown laws will be required to be assumed in action on the Sun; nor hitherto unsuspected force. With the corona gone, we can behold in the Sun a heated sphere with no more gases surrounding it than would naturally arise from so massive a body in the Sun's known chemical activity. With the revival of astronomy two centuries ago, mysteries in cosmical research begun to vanish, and if the corona shall prove illusory; and if more delusive ideas disappear, doubtless we shall all be surprised at the simplicity of that vast machine—the solar system.

NEW WINDSOR, ILL., September 10, 1883.

ASTRONOMICAL NOTES FOR OCTOBER, 1883.

W. W. ALEXANDER, KANSAS CITY, MO.

The earth's annual motion around the Sun brings time on the 1st to R. A. 12 h. 30 min., on the 31st 14 h. 22 min. His south declination will increase from 3° 14′ on the 1st, to 14° 9′ on the 31st. The sidereal time of local Mean Noon on the 1st is 12 h. 40 min. 32.4 sec., on the 31st 14 h. 38 min. 49 o sec.

VENUS—is evening star, but as yet too near the Sun to be of much prominence. On the 4th she will be in conjunction with Mercury.

MERCURY—will pass inferior conjunction on the 6th, and attain its greatest western elongation on the 22d. A few days before or after that date it can be seen risng about eighty minutes before the Sun at a point on the horizon almost due east. On the 20th it will be close to Gamma Virginis; the star will be to the north 1° 07′.

MARS—is in the constellation Gemini on the 1st, where it will remain until the 7th, after that time it will be in Cancer. On the 3d it is in line with Castor and Pollux and south from these two stars. It rises about 11 o'clock P. M, 20° north of east. Its apparent diameter is slowly increasing, also its brilliancy. On the 19th Jupiter pays him a visit and at nearest conjunction will be south 59′, or about one and a half times the Moon's apparent diameter. On the 24th it goes

through Præsepe where it makes two beautiful telescopic occultations of faint stars.

JUPITER—is in right ascension 8 h. 12 min. to 8. 25 min., declination 20° north. It is in the constellation Cancer and rises about 11 o'clock P. M , 20° north of east. The mean apparent diameter is 36″. The four satellites, Io, Europa, Ganymede and Calisto present many beautiful eclipses this month.

SATURN—will rise early in the evening about 19° north of east. Apparent right ascension on the 1st 4 h. 34 min., on the 31st 4 h. 29 min.; this position places it within the confines of the constellation Taurus. The rings are probably situated for observation, the earth being elevated above their southern surface 25° 47′.

URANUS—is in right ascension 11 h. 41 min. to 11 h. 47 min., declination north 2°; it will rise about two hours before the Sun a little north of east. It will be in the constellation Virgo. On the morning of the 13th it will be in close conjunction with Beta Virginis; the star will be south only '5, about one-sixth the diameter of our Moon.

NEPTUNE—will be in the constellation Aries during the entire month. Its position is favorable for telescopic inspection. Without the aid of a very fine glass it is a waste of time to try to see this planet. The right ascension on the 1st will be 3 h. 15 min., on the 31st, 3 h. 12 min., declination north 15°. It will rise about 7 o'clock P. M. On the 17th it will be occultated by the Moon.

The Moon will be partially eclipsed on the 15th; all the phases are visible. The time used below is Kansas City mean solar:

	Days.	Hours.	Minutes.
Moon enters penumbra	15	10	22.1
Moon enters shadow	15	11	40.2
Middle of the eclipse	16	00	36.0
Moon leaves shadow	16	1	31.8
Moon leaves penumbra	16	2	50 2

Magnitude of the eclipse =0.280, (Moon's diameter =1).

Circumstances of the eclipse are, first—contact of shadow with the Moon's limb 132° from the north point toward the east, when she is in the zenith in longitude 93° 55′ west from Greenwich, and latitude 9° 29′ north. Last contact of shadow with the Moon's limb 165° from the north point toward the west, when in the zenith of west longitude 120° 50′, and latitude 9° 49′ north.

The best time to see the circular form of the earth's shadow will be at the middle of the eclipse, when it will be projected on the southern limb of the Moon.

Eclipses are caused by opaque bodies casting a shadow when the rays from any luminous body fall upon them. Every primary and seconary planet in the solar system casts a shadow towards that point of the heavens which is opposite to the Sun. If the Sun were smaller than the earth, the earth's shadow would increase in diameter as the distance increases from the earth, but if the Sun and earth were of the same size, the shadow would be of the same size, no matter how

great the distance from the earth. But as the Sun is immensely larger than the earth, the earth's shadow terminates in a point at about 850,000 miles distant; the length of the earth's shadow is, however, subject to considerable variation. When the earth is nearest to the Sun, which takes place about January 1st, the shadow is much shorter than when the earth is at its greatest distance, which is about the 1st of July. The Moon revolves around the earth in about twenty-nine and one-half days, from one new moon to another. If the Moon passed at every new moon exactly between the centres of the Sun and the earth, we would have a great eclipse of the Sun at every new moon, and a total eclipse of the Moon at every full moon, but the Moon's orbit or path makes an angle with the plane of the ecliptic (the plane of the ecliptic is described by a line drawn from the centre of the Sun, passing through the centre of the earth and extended to the heavens,) of about 5½°, consequently one-half of the Moon's orbit is above the ecliptic, and the other half is below it. The two opposite points where the Moon's orbit cuts the plane of the ecliptic, are called the Moon's nodes. The nodes do not keep in the same position with respect to the earth and Sun, but have a retrograde motion of about 19° in a year. This causes the Moon at new moon to be too high or too low, so that the Moon's shadow passes above the north pole or below the south pole, hence there is no eclipse; and at full moon, the Moon passes either above or below the earth's shadow. A total eclipse of the Moon occurs when the whole of the Moon is immersed in the shadow of the earth, but we occasionally have a partial eclipse of the Moon (as the one above), which is caused by the Moon's being so high or low as to be only partially immersed in the shadow of the earth. The Sun and Moon appear to be about the same size, but the apparent size of both is subject to some variation. Eclipses of the Sun are more frequent than of the Moon, because the ecliptic limits of the Sun are greater than the Moon's, yet we have more visible eclipses of the Moon than of the Sun, because eclipses of the Moon are visible from all parts of the earth, where the Moon is above the horizon, and are equally great to each of these parts; but eclipses of the Sun are visible only at those places upon which the Moon's shadow falls.

Eclipses are among the most interesting phenomena presented to us by the heavenly bodies. In all ages, when an eclipse has taken place, it has excited the profound attention of the learned, and the fears and superstitions of the ignorant. The causes of eclipses before the seventeenth century were known only to a few, and they generally took advantage of this knowledge to impose upon the credulity of the ignorant by pretending that they were inspired by the gods. Among the ancient nations, the Chaldeans were the foremost in their observations of the phenomena of the heavens; perhaps this was owing in some measure to their occupation. They being shepherds, were obliged to watch their flocks by night to protect them from the wild beasts which were at that time very numerous.

The Chaldeans, by a series of observations extending through several centuries, discovered a very important fact in relation to eclipses, although they did not understand the cause. By comparing the records for many years past they

found that a certain period of time elapsed between eclipses of the same kind and magnitude; that is, if 18 years 11 days 7 hours and 43 minutes were added to the time of the happening of any eclipse, it would show the time of the return of the same eclipse.

SUN AND PLANETS FOR OCTOBER, 1883.

W. DAWSON, SPICELAND, IND.

The Sun's R. A. October 1st is 12 h. 30 min., and 14 h. 22 min. on 31st—a much greater increase of R. A. than in September. His declination south will be marked during October; being from 3° 15′ to 4° 10′ south of equinoctial. This causes a decrease in the length of days from 11 h. 40 min. on the 1st to 10 h. 22 min. on the 31st. Spots on the Sun have been quite numerous during the first half of September. The greatest number observed thus far (Sept. 17th,) is 90, on the first; least number 50, on the 10th; on the 14th, 80 were counted. A very large sun-spot was visible to the naked eye (with shade-glass) from 3d to 14th. An aurora with several bright streamers occurred on the 16th at 9 P. M.

New Moon occurs within a few minutes of the advent of October, and also on the 30th, about 6 P. M. On the latter date there will be an annular eclipse of the Sun, visible over the northern Pacific Ocean; central from Japan to Hawaii. Full Moon occurs October 15th, soon after midnight; when there will be a small eclipse of the Moon visible throughout the United States. The Moon will pass over a small star on the 18th, near 8 P. M. This occultation can probably be observed with a good sized spy-glass. There will be several occultations of stars by the Moon during the month, but not of much interest to those not having large glasses.

Mercury comes to its inferior conjunction with the Sun October 6th, after which it will be morning star. The best time to observe it will be about the 22d, when it may be seen with a small glass, and possibly with naked eye about 4° south of the east point. Venus is evening star, but too near the Sun all the month for observation. Jupiter is the brightest of all the morning stars. It is high up in the sky, and crosses the meridian soon after 7 A. M. in the early part of the month. On the 31st it souths at 5:40 A. M. Its declination is about 20° north all the month. Its four moons and most prominent belt may be observed with a good spy-glass. It is a grand object with a telescope three inches or more in diameter. Mars is about 7° or 8° west of Jupiter in the first of the month; comes up with and passes the great planet on the 19th; and about the 24th passes through the Bee Hive cluster in the constellation of Cancer. Saturn is a fine morning star (as to meridian passage) near 4° north of Aldebaran in Taurus. It rises at 8:40 P. M. on the 1st, and two hours earlier on the 31st. Its declination is the same as that of Jupiter, 20° north. It is about 15°, one hour east of the seven stars. For observation with a good sized telescope, Saturn is one of the

finest and most interesting objects which the heavens afford. Uranus is just entering the constellation Virgo. It is now a morning star, and too near the Sun to be observed, though it might probably be seen with a telescope toward the end of the month, especially as it is very near a third magnitude star, Beta in Virgo. Neptune occupies a blank region in Taurus, near 8° southwest of Pleiades; R. A. 3 h. 15 min.; declination 16° 12′ north on the 1st. It changes place but little during the month. The brightness of this planet is about that of an eighth magnitude star, and hence requires a pretty fair little telescope to show it.

CORRECTION.

EDITOR REVIEW:—I have noticed two errors in my Table of Eclipses (REVIEW, No. 4, Vol. VII,) which it might be well to publish with their corrections. (They are my own, not the printer's). The eclipse of 1881, November, should read November 21st, 7 A. M., instead of "November 20th, midnight," as I put it; and 1882, "May 16th," should read May 17th.

W. DAWSON.

METEOROLOGY.

PRACTICAL HINTS REGARDING TORNADOES.

JOHN D. PARKER, U. S. A.

The following hints regarding tornadoes are given in the belief that many people are killed every year who could save their lives by a little practical knowledge of the movements of these destructive storms.

The tornado *season* is embraced between the 1st of April and the 1st of September, but in the latitude of Kansas City most tornadoes occur in the months of May and June. As we go north or south of this latitude they are proportionally earlier or later, and early or late seasons vary the time of their occurrence correspondingly.

Tornadoes occur in the *afternoon*, generally between two o'clock and evening, four o'clock being called the tornado hour.

Tornadoes move from southwest to northeast, generally *east about twenty degrees north*, and their linear movement is ordinarily from thirty to forty miles an hour.

Tornadoes occur on *sultry* days, or when the temperature is very high and the air is thoroughly saturated with moisture.

Tornadoes occur when the *electrical conditions are high*, or when the air is highly charged with electricity.

The approach of a tornado may be known by ominous clouds appearing in the southwest and northwest. The clouds sometimes resemble the smoke of a hay-stack, at other times they appear like iridescent fog. Sometimes they present a deep greenish hue, or are intensely black, or have a purplish, yellowish or bluish tinge. When these two masses or banks of clouds, under the impulse of opposing currents, approach each other they are thrown into great confusion, there is a roaring, likened to the rumbling of distant thunder, and an upward expulsion of air and vapor. Soon the funnel of the tornado is let down to the earth, and moves to the front, while scuds of clouds play around it. The tornado now formed has four characteristic movements: a linear movement toward the northeast; a gyratory movement, (north of the equator,) contrary to the hands of a watch; a zigzag or swaying movement which leaves dentated edges in the path of the tornado, and a rising and falling movement, the poise of the upper current, by which the tornado leaps over portions of its path.

If one is familiar with these premonitory signs, he is put on his guard, and when the tornado appears, he is prepared to act intelligently and promptly. Under the preceding principles he can easily determine the projected path of the tornado, from the location of the funnel, and whether it will be necessary to run north or south to escape from it. He must, of course, not run east or west.

When a tornado is imminent certain precautions should be observed. Doors and windows in houses should be closed, animals in harness unhitched, and animals in stables let out. The safest place in a house is the southwest corner on the first floor, or better perhaps, the southwest corner in the cellar. If a tornado overtakes one on a prairie, lie face downward, head toward the east, and place the hands over the head for protection. If near a low solid object, like a large stone or stump, lie face downward, east of it, head towards the object, with hands over the head for protection.

Every home should have a dug-out at a convenient distance from the house, or what is better, a tornado-room built into the west or south wall of the cellar, large enough for the family, and for things of great value like deeds or money.

The destructive effects of tornadoes result from the gyratory movement, which is estimated at from one hundred to five hundred miles an hour. Tornadoes with the hour-glass form of cloud are the most intense, and seem to be irresistible, but the greater number of tornadoes are of a lower intensity and we can build against them. Frame houses are more tenacious or elastic than brick or stone, and when overthrown are not so destructive to life. They should have strong frames. Brick houses should have an extra layer of brick laid in cement in the west and south walls. Stone houses with very thick walls laid in cement are comparatively safe against most tornadoes.

Houses built near a hill or a bluff presenting an elevation should be located on the northeast side, as the elevation tends to lift the tornado over the house. A grove of hard wood, such as oak, maple, walnut and hickory, southwest of a house, or a forest southwest of a town has a tendency to break the force of a tornado and drive it into the upper air, although it is not safe for a person to be

near a tree, or in a grove during a tornado for fear of being struck by flying timber. Occasionally a tornado of great intensity will cut a clean swath through a grove, but forests tend to break the force of tornadoes, and will drive most of them into the upper air. All towns in prairie States should plant heavy groves of hard timber southwest of them. During a residence of forty years in southern Michigan when it was heavily timbered, tornadoes were unknown; that is, they were driven into the upper air and rendered harmless, but since the forests have been cut away tornadoes in that part of the State have become somewhat frequent and destructive. Not to build and protect against tornadoes seems like not taking medicine for fevers. Sometimes a fever proves fatal, but most fevers can be cured, and so most tornadoes can be rendered comparatively harmless.

By a careful study of the principles which underlie these storms, and an observance of the premonitory signs, during the tornado season, it is believed that few, if any persons, who keep their presence of mind and act intelligently and promptly, when the storm appears, need be killed by a tornado. Still it is always best to have a clear conscience whatever may happen.

Meteorologists are carefully studying these storms. The Signal Service already, in their daily reports during the season, indicate the barometric trough of low pressure, extending from the southwest toward the northeast, along which tornadoes move, and it is believed that the time is not far distant when they will predict to certain districts probable tornado days.

FORT STOCKTON, TEXAS.

TORNADO THEORIES.

In the discussion which followed the reading of Dr. P. R. Hoy's paper upon The Tornado at Racine, Wisconsin, May 18, 1883, before Section B of the American Association for the Advancement of Science at the Minneapolis meeting, the following statements and suggestions were made by some of the distinguished physicists present:

Mr. Hoy's paper began by stating that the early part of the day was pleasant, but about 6:45 in the evening two clouds of ominous appearance joined, from opposite quarters of the heavens, and at once the cyclone began. Its general direction was to the north of east. There was no rain at Racine with the storm, but there was noticed a very strong odor of ozone while the cyclone was at its height. At the start it was barely two rods wide, but when it reached Racine it had expanded to twenty rods. Its motion was rotary and oscillatory, and all *débris* was thrown to the centre of the track. When the cyclone crossed the lake it formed huge water-spouts, one central, and seven to eight accessory, whirling about the main trunk.

Prof. H. A. Rowland proceeded to discuss the paper as follows: Most observers of tornadoes just perceive that there is a whirling motion of the air, and t knocks down objects, and that is the principal thing they see. But that is very

ordinary observation. Of course, a column of air in such swift rotation will tear houses down, spurt water up, and do everything of that sort. The particular point which I observed in this paper was the description of the formation of the tornado. The phenomenon which is to be explained is the formation of the tornado, and very few have observed this. This description was very short; merely, that, over in the west or southwest, the clouds formed. Of course, to an observer from the west, one would appear north, and the other south. The point I wish to bring out is, that there was lightning passing between the two clouds. In Mr. Finley's description of six hundred tornadoes, I do not see any similar account. Many observers have seen lightning play around these clouds, but not passing between the two clouds. Mr. Finley applied to me to know whether there was anything in the electrical theory of a tornado. Of course, any theory of the destruction being caused by electricity, houses being attracted, etc.,—all that is mere nonsense. We know that the attraction of electricity is only a mere fraction of an ounce to the square inch Before the force becomes sufficient to raise a great weight, a spark passes, and a discharge of electricity takes place. But in this case (these two clouds passing from north to south, and boiling up, having flashes of lightning playing around them), I thought that there might be something in the electrical theory, as far as formation was concerned; and I calculated for the Signal Service and Mr. Finley what amount of energy there was in two clouds approaching each other in this way. The rotation of the earth will cause them to come together, not in a straight line, but a little aside from each other, forming a spiral motion. The direction of the rotation of the tornado is a necessary consequence of the earth's rotation: so that it might be possible to have these electrified clouds approach each other by mutual attraction, and form a tornado at the point where they meet. I calculated the energy, and found there was sufficient for a rather small tornado in the case I took. I would not be willing to say that is the theory of all tornadoes. I say that it is only possible. There is a great deal more energy in a mass of air heated up to a considerable temperature, and rising by force of gravitation,—a great many times more. If it were not for the electrical phenomena observed in the case, I should say there was very little probability of the electrical theory. I believe Mr. Finley will direct the Signal Service observers to watch the direction of the wind. If it flows in from all directions at the point where the tornado is formed, we should determine it to be due to the rise of hot air at that point. When the ground is very hot and the air very sultry, we have two causes; and it is only by observation that we can find out its true manner. I do not lay very much stress upon the electrical theory. But it is an interesting point, to me, to notice that flashes of lightning have been observed between these two clouds, showing that they were differently electrified, and that there was some plausibility for the theory which I sent to the Signal Service.

Prof. F. E. Nipher continued this discussion the next day, as follows: One matter connected with the effects of this tornado contained a point, it seems to me, of sufficient interest to call the attention of observers to the matter, in case

any one should have an opportunity to observe the effect of a tornado upon water. Mr. Ferrel, I think, in his description of a tornado, states that we have a rising of the water, forming a sort of cone in the centre of the tornado; the effect being, of course, ascribed to the diminution of pressure which is known to to be there. In the cyclone proper, where we have a large area, we have a storm-wave as the principal element in the case, and there is an upheaval of the water in the area of low pressure. In the tornado it seems to me very questionable whether that occurs. I base that upon this observation: A smaller wind-whirl which was observed by myself in northern Missouri, which was rather violent though not destructive,—a column of dust several hundred feet high being raised,—passed out upon a pond of water five or six feet deep, and a depression was formed in the water, extending to the bottom of the pond,—an immense cup. The water was revolving rapidly; and it was thrown into rotation with a centrifugal effect,—the same effect as when a vessel is whirled. It seems to me that this is an element which has not been considered as it should be. If the whirl is small, and you have not only a diminution of pressure in the centre, but of the whole body of the water, the friction producing a rotation of the water, if the result is sufficiently small you might get a depression instead of an elevation. I call attention to this, so that those who may be fortunate enough to see a tornado on the water may not take it for granted that it is all known.

As to the remarks of Professor Rowland in regard to the possible electrical origin of a tornado, I know that he was very careful to say that he did not think any of the destructive effects could be ascribed to the action of electricity. I gathered the idea that he thought a tornado might originate in that way,—that two electrified clouds will attract each other, and come together; and he calculates the energy of the attraction which bodies can have for each other in air. It seems to me that the simple observation that was made by Mr. Hoy, together with another fact which we know,—that when the discharge passes between electrified bodies they are almost wholly discharged,—would show that when that happens the cause for that motion has disappeared. When these two clouds approach, a spark passes, and the whole thing is gone. So long as there is no spark passing, we know very well that the attraction is very much less than the maximum attraction of $\frac{16}{100}$ of an ounce on the square inch. I think, perhaps, that is a matter Professor Rowland did not consider. It does not seem to me at all likely that any such origin can be ascribed to the tornado. When it is developed, you may have a rarefied column which may be very highly rarefied, connecting the earth with the upper regions, which is precisely the reason that the lightning which was observed in the case of the Racine tornado was not accompanied by thunder.

Professor J. T. Lovewell said that it occurred to him, from his observation, that a good deal of care is necessary in order that the observer may know exactly what he sees. It was my fortune, said he, to witness a small whirl at a distance of three of four miles. I saw the funnel-shaped cloud descend toward the earth, and it looked to me as though there were a column of water. Many people who saw it spoke of it as a waterspout. It might have been water, for aught that we

could have said from our point of sight. I immediately drove to the spot, and it appeared that not a drop of rain had fallen in that track. The whirl had been sufficient to overturn a few stacks of grain and hay, and a man was thrown about with his team in the road. I think, if it had struck a body of water, I should be slow to believe that it lifted any solid column of water into the air one hundred feet. It would have made a grand scattering of the water, and a great deal of it would have been thrown up into the air. I believe that a good deal of that which is commonly ascribed to columns of water rising up, and pouring down the sides in cataracts, is optical illusion. I should be slow to take the testimony of a person seeing them, unless he had his mind disabused of the common notions about these waterspouts. So far as their electrical origin is concerned, I quite agree with Professor Nipher that it is not by any means proven that electricity has anything to do with them, except that it is a necessary adjunct, of course, to all such disturbances.—*Science.*

REPORT FROM OBSERVATIONS TAKEN AT CENTRAL STATION, WASHBURN COLLEGE, TOPEKA, KANSAS.

BY PROF. J. T. LOVEWELL, DIRECTOR.

TEMPERATURE OF THE AIR.	Aug. 20th to 30th.	Sept. 1st to 10th.	Sept. 10th to 20th.	Mean.
MIN. AND MAX. AVERAGES.				
Min	. .	. .	. .	. .
Max	.	. .	. .	. .
Min. and Max	. .	. .	. .	. .
Range	. .	. .	. .	. .
TRI-DAILY OBSERVATIONS.				
7 a. m.	64 4	60.95	58 60	55.0
2 p. m.	84 8	79.50	81.00	69.8
9 p. m.	66.9	64.00	63.00	58.7
Mean	70.7	68.15	66.40	60.3
RELATIVE HUMIDITY.				
7 a. m.	.91	.85	.93	.87
2 p. m.	.44	.51	.60	.60
9 p. m.	.81	.78	.84	.84
Mean	.71	.72	.86	.77
PRESSURE AS OBSERVED.				
7 a. m.	29.15	29.217	29.217	29.01
2 p. m.	29.12	29.077	29.042	29.98
9 p. m.	29.11	29.038	29.059	29.97
Mean	29.13	29 177	29.106	29.99
MILES PER HOUR OF WIND.				
7 a. m.	8.2	. .	. .	. .
2 p. m.	12.2	. .	. .	. .
9 p. m.	11.0	. .	. .	. .
Total miles	1282	2785	2313	6380
CLOUDING BY TENTHS.				
7 a. m.	1.5	4.7	5.9	. .
2 p. m.	1.0	3.7	4.0	. .
9 p. m.	0.6	2.4	4.8	. .
RAIN.				
Inches	.00	.00	.55	.55

The month included in this record has been warm and dry compared with the two preceding months. There was no rain during the first two decades, and the slight rains, from September 14th to 16th, ushered in a change, so that on the 17th slight frost was reported in low lands near Topeka. This is the only frost so far this season and it did no damage.

The wind-travel has been less than usual, the most noticeable being that of September 20th which came from the north and was so marked a disturbance as to have attracted general attention through the conntry. This cold wave would doubtless have brought the frost predicted by the Signal Service had it not brought instead a cold rain.

PHYSICS.

THE TELEPHONE SERVICE AT KANSAS CITY.

The telephone service of Kansas City is about to enter upon a new and greatly changed era. Those vexatious delays and uncertain connections, which have caused many righteous men to desire, and often attain, profane heights where their feelings could be vented consistent with the telephonic demands on them, bid fair to soon become features of the past. As has been the case with other cities we have outgrown the telephonic system, so called, that was constructed when this electrical wonder was in its infancy—and its use and abuse unknown, and for eight months past have been experiencing the discomforts of what, in telephone parlance, is known as "reconstruction"—constructing anew the entire telephonic system of the city. The most difficult part of the outside work was that of setting larger and stronger poles in place and transferring to them the multitudinous wires that loaded, beyond their capacity, the unsightly poles that have been a feature of our streets since the advent of the telephone. The new cedars and chestnuts as a rule are straight and clean, and when painted, as they are to be, will be a decided improvement in appearance as well as efficiency. For a distance of a block, and sometimes two, from the new operating room at the corner of Sixth and Delaware Streets fifty-wire cables have been strung, doing away with the necessity of that multiplicity of wires at the "central office," where so much of the line "trouble" has had its origin in the past. This is a new and quite expensive departure in telephonic circles and, if as successful as the cable inventors predict, will greatly aid in solving the aërial wire problem. Each wire is insulated and maintains its individuality from cable-box to operating-room. On each pole, where a cable terminates, a cable-box is secured and here the cable is "stripped," each wire carried to a screw and burr over a lightning arrestor, and out to its proper pin by means of kerite wire, and then connected with the subscriber's line, constructed of No. 14 steel wire. The light-

ning arrestors are for the purpose of carrying the electric charge, that the heavens may send, to mother earth, preventing it from entering the cable, burning through the insulation and reaching the operating-room where the damage it could do in a second can scarcely be estimated. The cables are supported on No. 4 iron wire, so hung that there is no strain on the cable. At the operating-room, where the strain on the office pole caused by the weight of the cables is something enormous, a very elaborate system of "guying" has been constructed, and the poles evenly held in place that in all probability they would retain their positions were they sawed in two.

The outside work which will increase the capacity more than one hundred per cent and, it is predicted, improve the service so that "trouble" will be reduced to the minimum, is but one of the elements in the improvements being made. The operating-room on the fourth floor of the Wales Building, Sixth and Delaware Streets, is just now receiving its finishing touches. No one except those engaged in the practical management of an exchange appreciates the difficulties to be overcome in handling the connections that subscribers may call for in a large exchange. The *Electrical Review*, of New York, says:

"The people at large, uninformed of the difficulties of the undertaking, are surprised and disappointed that electricity, after giving them so wonderful an instrument as the telephone, hesitates to make the use of it conveniently universal. It is difficult to persuade them that there is, physiologically speaking, *ten times* the amount of valuable inventive tissue already expended on telephonic apparatus that there is on the telephone itself. It is a misfortune of the telephone business that the difficulties in the way of prompt and reliable service are not properly appreciated."

The above paragraph appears in an article accompanying a full page illustration of the new switchboard of the Kansas City telephone exchange. It is known as the "multiple switchboard," and consists of two more switchboards, to each of which is connected all of the lines of the subscribers of the exchange, and is designed to enable many switchmen (or switchladies, as young ladies are to be the operators in the city hereafter) to operate the same wires on the different boards without interference. A simple test is provided by which the operator can tell instantly, without questioning another operator, whether the line desired is free or "busy." The spring-jack (the receptacle for the connecting plug) used with the board is a small and peculiar looking combination of phosphor-bronze spring, screws and burrs and insulating compounds. The spring and contact point, against which the spring nominally rests, are both insulated from the frame of the jack which is connected by an independent wire to all its duplicate frames. In the Kansas City office three switchboards are in place, giving a capacity of six hundred wires. Others are to be added. All the lines come to the first board from the cable, which is carried under the floor to the back of the switchboard, where it is separated and each wire numbered. They are then carried to the same number on the switchboard, connecting to the spring of the jack, passing through the spring and the contact point without touching the frame of the

jack, the wire continuing to the same spring on the second board and from there to the third, and then returns to the subscribers' signalling board, where it passes through the "drop" (also numbered the same as the switchboard connection) and thence to the ground. All wires are run in this manner: from cable to first board, from that to the next and so on to the last, and from that to the annunciators, and from there to the ground. A subscriber can be called up from any of the duplicates or be answered from any, but the idea of the board is to have each operator answer one hundred subscribers and be able to connect them with all other subscribers, be they two hundred or two thousand. Two operators stand, or perch on stools, in front of each board, the annunciators at their sides. For example: should subscriber No. 80 call for connection with No. 430 the operator at the board where No. 80 comes in quickly tests, by means of a plug applied to the duplicate of No. 430, whether that line is busy or not, and if not the two are promptly connected by plugs and cords. The test plug is in circuit with a battery that sounds forth a warning "click" when applied if the line wanted is busy; if not busy there is no sound at all. When through talking the subscriber calling is expected to "ring off", which throws down the clearing out-drop immediately back of the set of plugs and cords that connected the two, and thus signals the operator that they are through. The failure of the subscriber to "ring off" is a very decided source of annoyance in all exchanges.

To set up switching apparatus of this kind, trace out thoroughly, and test the thousands of wires necessary is a task requiring the finest skill. To be able to do this and yet conceal every wire and every connection, shutting out all that might be termed unsightly, required not only skill but also superior taste. The privileged visitor to the Kansas City Exchange, of to-day, is greeted with a vision of elegant switchboards of cherrywood, a room handsomely carpeted and richly papered, and pretty young lady-operators, who in soft and pleasant tones are answering subscribers. No loud talking is heard or permitted, and the thousands upon thousands of connections asked for daily are, as a rule, made quickly and easily.

This work from its conception to its close has been under the personal supervision of Mr. E. L. Smith, General Superintendent of the Missouri and Kansas Telephone Company, and Mr. Chas. W. Price, Manager of the Kansas City Exchange. These gentlemen take a just pride in the work they have done and to-day have the honor of being the executive officers of what has been pronounced by leading electricians, the finest telephone exchange in the United States. And Kansas City, now looking forward to better things in the telephone service, can feel proud that she has in her midst a company with the capital and enterprise to carry through this work, with its thousand and one annoying features, to so successful an end. To expend not less than $40,000 in improvement of what is one of the greatest public conveniences and necessities of the present age, is a creditable thing for any company to do, and this is what the Missouri and Kansas Telephone Company has done for Kansas City.

BOTANY.

CONCENTRIC RINGS OF TREES.

A. L. CHILD, M. D.

In the Kansas City REVIEW, Vol. VI, No. 8, an article is published which was prepared by me on the "Annual Growth of Trees," in which I announced the (to me) surprising fact that the concentric rings of trees, were not a reliable index of their age.

The proof on which that article was based, was confined to four red maples of twelve years' growth; one of which exhibited forty eccentric rings, and the others only a few less.

Having no positive evidence of this singular departure from the world-wide and time-honored law, that the age of a tree is known by the number of its concentric rings, I was in doubt as to whether this departure was confined to the maple, or might extend to other families.

The assistance of kind friends has enabled me to accummulate evidence, which I think authorizes me to say that the concentric rings are not reliable indications of the age of any tree.

Desiré Charnay in *North American Review* of September. 1881, p. 401, says on the subject of this reliability of annual rings "Unfortunately for the argument, it is altogether fallacious, and proves nothing. I have put the evidence to the test."

J. T. Allan, Esq., Superintendent of tree-planting for the U. P. R. R., says in a letter of July 31, 1883: "Every man who has given any attention to this matter of yearly tree-growth *knows* that the rings are no index to the age of the tree."

Hon. J. J. Wilson, of Bethel, Vt., an experienced lawyer, and late Senator in the Legislature of Vermont, writes me, August 15th, that in a land title suit in the Windsor County District Court, held in Woodstock, in June, 1883, where claim was based on a certain marked hemlock tree, that a section of the tree inclosing the mark was produced in court, and that the rings outside of the mark counted up to forty or fifty; while the same rings followed around to the opposite side coalesced and joined till there were but nine or ten. The court ruled them out as evidence inasmuch as "they gave no indication, as to the age of the tree, or the time since the mark was made."

Hon. Rob't W. Furnas, of Brownville, Neb., late Governor of the State, and a practical forester of almost world-wide reputation says, (commenting on a letter of mine): "In reply to the letter of Dr. A. L. Child, in reference to the

discussion concerning annual growth of trees * * * * , I have to say briefly that my experience coincides with that of the doctor. Formerly, I believe it was almost or quite universally conceded that what were familiarly known as annual rings, were unerring indications of the age of the trees. I *know* they are not."

Governor Furnas attended the recent American Congress of Forestry at Minneapolis, Minn., and reports that this subject was introduced in the Congress, and that Prof. Budd, of the Iowa Agricultural College, presented a specimen of known age, or near fifteen years, with thirty rings; also some specimens of spruce frome Puget's Sound, one foot in length, with eighteen rings on one end and twelve on the other.

This drew from Commissioner Loring, the opinion that "it settled the question that rings could not at all times be relied upon."

The Governor has also kindly presented me with sections of several trees of his own planting or of positively known growth and age; viz.: a black-walnut of five years with twelve rings. A green ash of eight years and twelve rings. A pignut hickory of eleven years and twenty four rings. A burr oak of ten years and twenty-four rings. A Kentucky coffee tree of ten years and twenty two rings.

H. P. Child, Superintendent of the Kansas City Stock Yards, contributes a pine of eight years and twelve very distinct rings with nineteen additional finer or sub-rings; also a soft maple of near fourteen years and sixteen very distinct, and *sixty-three* fainter or sub-rings.

I will add, that of most of the previously described specimens, there can be more generally found certain more distinct and pronounced rings, which will answer to the commonly received annual rings; and yet they very frequently, in other parts of the circumference, run into and are lost in, or entirely overshadowed by the sub-rings to such an extent that it authorizes the common expression of all who have thoroughly examined the question that "the rings cannot be received as a reliable index of the years of trees.

EXPLORATION.

THE LOSS OF THE PROTEUS.

On June 29th the United States Steamers, Proteus and Yantic, sailed from St. Johns in search of and for the relief of the Arctic exploring party that went out under Lieutenant Greely in 1881. On the 13th of September the Yantic returned to St. Johns alone, bringing the officers and crew of the Proteus, which was crushed in an ice pack at the entrance to Smith's Sound, 200 miles south of Lady Franklin Bay—the point of destination—on the 23d of July, less than one

month after her departure from home. The story of the disastrous voyage is briefly told:

The Yantic and Proteus left St. Johns at 4 P. M., June 29th. The Proteus arrived at God Haven, Bay Disco Island, July 6th. The Yantic arrived at the same place July 12. When the necessary preparations were made the Proteus sailed for Cory Island, arriving there on the 16th. It left on the 21st, and two days afterward was crushed, sinking at 7 P. M., July 23d. Twenty-nine days were spent in the boats, several storms were encountered, from which the boats took refuge under lee of the icebergs, and Lieut. Colwell and six of the crew parted company with the others at Cape York. They found the Yantic July 31st. It reported Capt. Pike and the remainder of the crew moving southward. The Yantic reached Cory Island August 2d. The same night she proceeded to Pandora Harbor, where records from Pike and Garlington were found. She next proceeded south along Greenland coast, sending boats all around the islands in search of the missing crew. A storm and heavy pack of ice, August 9th, forced the Yantic to anchor to leeward of the Northumberland Island. The next day she bore away for Upernavik, arriving there August 22d. On the 27th she started for the Waigate coal mines, and returned to Upernavik September 2d. Capt. Pike and crew were found and taken on board the Yantic. It seems that at the first intimation of the Proteus disaster, which was found August 3d, at Littleton Island, by the Yantic, Lieut. Garlington left a record there that he was coming south, describing the shipwreck and indicating the general movement of Capt. Pike and the ship's company. On the 4th search was instituted along the Greenland coast from Cape Alexander to Cape Roberts, on every point likely to bring up with the retreating party. They searched until September 2d, when Upernavik was reached, and the whole Proteus party was found in good health and tolerable spirits. They were exposed during thirty-one days and nights in their boats, making some stoppages at intermediate harbors. The Proteus was crushed in the floe of ice at 3 o'clock in the evening of the 23d of July and sank within four hours. Fortunately sufficient time was given to save clothing, provisions, compass and other necessaries to meet what might prove a protracted voyage. On the 25th, the boats being equipped, provisioned and manned, a start was made. The scene of the disaster was eight miles north-northwest of Cape Sabine, latitude 79° 51′ N. Over 600 miles of ice and frigid sea was passed before Upernavik was reached.

The worst feature in the unfortunate Proteus expedition is that no provisions were landed or caches made, and all stores intended for the Arctic Colony's relief went down in the steamer. It does not follow that the band of scientific explorers who went out two years ago must be lost. But it makes their loss very probable. They have already passed two winters in their remote harbor, and on the 1st of September, if they followed instructions, they set out with their boats and sledges for the southward, expecting to fall in with and be picked up by sledging parties from the relief ship. That ship they will never see. It will be impossible to send another vessel far to the north this year. The Greely company must

therefore work their way for several hundred miles over almost impassable jagged ice, or they must go into winter quarters again when traveling becomes altogether impossible. In either event there is grave danger that their supplies will fail, and that their experience will repeat the sad history of Sir John Franklin and Lieut. Commander DeLong.

The officers of the Signal Service freely admit that the present situation of affairs is a serious one, but they do not regard it as in any sense hopeless.

In the first place, they say, Lieut. Greely's party had originally a supply of provisions which was calculated to last three years, or until the summer of 1884. This supply, they think, must have been very considerably augmented by the fish and game procured in the immediate vicinity of the Lady Franklin Bay station, so that if the party remains there it will not be in danger of starvation before next summer.

Gen. Hazen's orders to Lieut. Garlington, it is true, stated that the food supply of Lieut. Greely's party would all be exhausted during the present fall, but it is said at the Signal Office that this was an extreme statement based upon the most unfavorable supposition as to the amount of consumption, waste, loss, etc., and did not allow for any care or economy in the use of food or any increase of the available supply by means of hunting and fishing. It was a statement of the worst possible aspect of the case, intending to emphasize the necessity of relieving Lieut. Greely's party at once. It is positively asserted, therefore, by the acting Signal Officer that notwithstanding the contrary statement in Gen. Hazen's orders to Lieut. Garlington, Lieut. Greely has provisions enough at the Lady Franklin Bay station to last him until the summer of 1884, if he remains there until that time. If, however, as seems more probable to the authorities here, he should have abandoned his station on the 1st of September and retreated down the coast of Grinnell Land to the mouth of Smith's Land, expecting to find there a relief party or a depot of stores, his situation may shortly become critical.

How large a quantity of provisions he would find at Cape Sabine and Littleton Islands is not known, but it is feared that the supplies left there last year, and the small quantity saved from the wreck of the Proteus would not maintain Lieut. Greely and his men at the mouth of Smith's Sound through the coming winter, even if the party had shelter and fuel. Some help might be obtained from the Esquimaux of the Greenland coast could Lieut. Greely find and open communication with them, but this is admitted to be an uncertain reliance.

Persons who are not connected with the war or navy department, but who have long been interested in Arctic research and are familiar with the history of exploration in Smith's Sound, express grave doubts as to the ability of Lieut. Greely's party to retreat down to the coast of Grinnell Land on sledges after September 1st. Autumn sledge travel along that coast was found by the officers of the British Arctic expedition of 1875 to be practically impossible.

Nothing, it is thought, can be done to rescue the unfortunate men this fall. Their lives are now in their own hands, and their future depends almost entirely upon their own skill and judgment, and upon the chances of wind and ice.

Lieut. Danenhower, formerly of the Jeannette, and Mr. Tyson, formerly of the Polaris, express their willingness to take part in another Arctic expedition for the relief of Lieut. Greely.

The people of St. Louis are deeply interested in the fate of Dr. Octave Pavy, who went out with the Greely expedition. He was a citizen of that place and has many warm friends there. Dr. Pavy was a member of the first Howgate expedition and suffered the disappointment of its failure on account of the unseaworthiness of the Gulnare. He, however, did not return with the party but remained with Mr. Clay, of Louisville, Kentucky, at Disco Island off the coast of Greenland. Mr. Clay finally returned home but Dr. Pavy remained, and joined the Greely expedition on its arrival in 1881, as acting Assistant Surgeon, U. S. A.

Capt. H. W. Clapp, 16th Infantry, U. S. A., Chief of the Arctic Division of the Signal Service, now in St. Louis, gives his views of the condition of the Greely party to a *Globe-Democrat* reporter as follows:

"The least that can be done is to fit out another relief expedition at once. Efforts should be made to reach those twenty-five men even if there wasn't one chance in a hundred of success. Unfortunately the Signal Service Department has not one cent of money which can be used for such purpose, and the Government is placed in the attitude of standing idly by while there is a possibility that the prosecution of active measures would save the lives of the men who have gone out in its service. I don't see how any relief can be expected unless from private sources, and the people of the country ought to respond to the emergency. I have studied the subject carefully and I am firmly convinced that the least that can be done is to send out another party at once."

"From where would you start it?"

"St. Johns is the headquarters for the sealing trade, and it was there that the Neptune and Proteus were both obtained. There are other ships at that port nearly as good as either of them, which were considered admirable for their purpose, and at the proper time of year a crew of men could be obtained without difficulty for the trip. It is not too late in the season yet to set out. An expedition could be got away from St. Johns by October 1st. This should push as far north along the coast of Greenland as possible, reaching the Carey Islands, if possible, before going into winter quarters. They would then be in position to succor Greely should he make a successful retreat thus far, and would be in position from which they could move north in the spring if Greely failed to come before that time. There is prospect that such an expedition as this I mention could get into a pretty high latitude this fall. The Alert, in 1875, reached her winter berth north of Greely's permanent station September 1st, and was not closed in for the winter until the 10th. She was released from the ice in the following year on July 31st, reached Discovery Harbor, August 10th, and the two boats, Alert and Discovery, crossed Lady Franklin Sound on the return August 20th, passed Cape Isabella September 9th, and arrived at Disco September 25th, only one stream of light having been fallen in with during all the voyage. The ships recrossed the Arctic circle October 4th, showing that navigation of these

waters is practicable some years until late in the season. An expedition going up this fall might find the ice fully as open as did the one which has just returned, without apparently having left supplies at the vital point of Littleton Island.

"Lieut. Greely, himself, after reaching his permanent station at Lady Franklin Bay, made out an elaborate plan under date of August 19, 1881, and this was delivered to Gen. Hazen on the return of the vessel which took the expedition out. No deviation has been made in the attempts to carry out his plans, but they have miscarried. Lieut. Greely's plans involved the establishment of caches and supply depots at frequent intervals along the west coast of Smith's Sound, on Grinnell Land, along the route over which he is probably now making a laborious retreat, but the Sound has been found impassable by reason of ice, both last year and this, and instead of having deposited supplies, the 1882 relief expedition got no farther north than Cape Sabine, and was unable to leave but a small quantity of supplies. The expedition this year appears not to have got much above Littleton Island, and not to have deposited enough supplies there to be of any importance. The expedition last year did everything that could possibly have been expected of it, unless possibly, in not having landed enough stores at Littleton Island, although they might have been ransacked by the natives if they had done so. Supplemental orders to this year's relief expedition required the landing of supplies before going north from Littleton Island, and even after the Proteus was caught in the ice there must have been an opportunity to save some of the stores. Lieut. Garlington is a thoroughly reliable man, and must have fully appreciated the importance of leaving the Littleton Island station thoroughly provisioned. It is not my province to criticise any officer, and even if criticism were just it is not necessary to discuss the reasons why the two relief expeditions failed to reach Lady Franklin Bay. The fact remains that Lieut. Greely and party are in a very precarious condition, and that, it seems to me, an attempt to relieve them should be made as early as possible."

Dr. Emil Bessels, of Washington City, who was chief of the scientific staff of the Arctic exploring steamer Polaris in 1871–3, and who has also had extended Arctic experience on the coasts of east Greenland and Navaya Zemaly, says: I was afraid there might be difficulty in communicating with Lady Franklin Bay stations, and bringing the party away at the conclusion of their work. It isn't every year that a vessel can sail up Smith's Sound and Kennedy Channel, as the Polaris did with Greely's party on board in 1881. I have a letter from Commander Markham, of the British Arctic expedition of 1875, written a year and a half ago or more, in which he, too, expresses fear that the United States Government will have trouble in relieving and bringing home this party. It has been suggested that a vessel might still reach the Danish settlement of Upernavik this fall and a sledge party might be dispatched northward from there up the Greenland coast to meet Lieut. Greely at the mouth of Smith's Sound, but this would not be practical. Greenland coast north of Upernavik and around Melville Bay is intersected by extensive glaciers which it is practically impossible to cross. If

sledge journeys could be made along this coast, the Etah Esquimaux, who live near the mouth of Smith's Sound, would communicate with the Esquimaux of Danish settlements, whose existence they are well aware of. Especially would they be likely to do this in times of famine, when, if they could reach Danish settlements, they could get food. But they have never done it simply because it is not practicable, even for them, and still less for white men. I think it is too late to do anything for the relief of the Greely party this fall. If Lieut. Greely and his men are now at the mouth of Smith's Sound they can without doubt find the Etah Esquimaux. Some natives of the tribe are almost sure to be living either at Etah or Sorrfolik, near the mouth of the Sound. Whether the Esquimaux could and would help so large a party as that of Lieut. Greely through the winter or not, I do not know. It would depend upon circumstances, and during the winter we spent at Polaris house, the Etah Esquimaux couldn't have been able to help anybody, for the reason they were at the point of starvation most of the time themselves. There are only a few of them. The whole tribe consisted of about 100 souls when we wintered in their country, and they are scattered along the the coast from the vicinity of Littleton Island to Cape York. I think there is a reasonable chance of Greely's being able to extricate his party from its difficulties. Lieut. Greely is, of course, in a dangerous situation, but it is possible for the party, if led with courage, skill and good judgment, to make its escape from almost any part of Smith's Sound unless the conditions are more than usually unfavorable.

Capt. Tyson is confident the Greely party is on its way to a place of safety, and that if it is attended with ordinary good luck it will reach a point where it can winter over, and where it can be found next June or July. In any event, he thinks there would be little use in starting out now to find the men. He confirms what has already been said about the hopelessness of trying to reach the shores of Kane Bay or Kennedy's Channel by sledging along the Greenland coast in the fall or winter. The Esquimaux of Upernavik and those living further up Melville Bay have no means of communication in winter, and if they cannot travel none others need try.

Sir George Nares, the distinguished Arctic explorer, writes the *Times* a few hopeful words to friends and relatives of those composing the Greely expedition. He says that there is still hope that Lieut. Greely may have reached Port Foulke late in the season.

Mr. Ford, of the New York *Tribune*, advises the sending of two vessels, one to go directly north and the other to skirt the Greenland coast north of Upernavik. The practicability of sending an expedition around the east coast of Greenland and attempting to reach Greely station from the north has been suggested, but the plan at this stage finds few advocates. The voyage has never been made, but Jan Mayer and a number of German and Danish navigators have sailed within a very few degrees of the pole by taking the water between Spitzbergen and Greenland, and it is stoutly maintained that there is an open sea to the north and west of that point.

ARCHÆOLOGY.

ANCIENT RUINS IN SONORA, MEXICO.

Ancient ruins have recently been discovered in Sonora, which, if reports are true, surpass anything of the kind yet found on this continent. The ruins are said to be about four leagues southeast of Magdalena. There is one pyramid which has a base of 1,350 feet, and rises to the height of 750 feet; there is a winding roadway from the bottom leading up on an easy grade to the top, wide enough for carriages to pass over, said to be twenty-three miles in length; the outer walls of the roadway are laid in solid masonry, huge blocks of granite in rubble work, and the circles are as uniform and the grade as regular as they could be made at this date by our best engineers. The wall is only occasionally exposed, being covered over with debris and earth, and in many places the sahuaro and other indigenous plants and trees have grown up, giving the pyramid the appearance of a mountain. To the east of the pyramid a short distance is a small mountain, about the same size, which rises about the same height, and if reports are true, will it prove more interesting to the archæologist than the pyramid.

There seems to be a heavy layer of species of gypsum about half way up the mountain, which is as white as snow, and may be cut into any conceivable shape, yet sufficiently hard to retain its shape after being cut. In this layer of stone a people of an unknown age have cut hundreds upon hundreds of rooms from 6x10 to 16x18 feet square. These rooms are cut out of the solid stone, and so even and true are the walls, floor and ceilings to plumb and level as to defy variation. There are no windows in the rooms and but one entrance, which is always from the top. The rooms are about eight feet high from floor to ceiling; the stone is so white that it seems almost transparent, and the rooms are not at all dark.

On the walls of these room are numerous hieroglyphics and representations of human forms with hands and feet of human beings cut in the stone in different places. But, strange to say, all the hands have five fingers and thumb, and the feet have six toes. Charcoal is found on the floors of many of the rooms, which would indicate that they built fires in their houses. Stone implements of every description are to be found in and about the rooms. The houses or rooms are one above the other to three or more stories high; but between each story there is a jog or recess the full width of the room below, so that they present the appearance of large steps leading up the mountain.

Who those people were, what age they lived in, must be answered, if answered at all, "by the wise men of the east." Some say that they were ancestors of the Mayas, a race of Indians who still inhabit southern Sonora, who have blue eyes, fair skin and light hair, and are said to be a moral, industrious,

and frugal race of people, who have a written language and know something of mathematics.—*Chihuahua Enterprise.*

BOOK NOTICES.

STUDIES IN LITERATURE: Edited by Titus Munson Coan. 12mo., pp. 267. G. P. Putnam's Sons, New York, 1883. For sale by M. H. Dickinson; Cloth, 50c.; Paper, 25c.

This is No. 3 of the "Topics of the Time" series and contains the following choice selections: American Literature in England, from *Blackwood's;* Hamlet—a New Reading, by Franklin Leifchild, from the *Contemporary Review;* The Humorous in Literature, by J. Henry Shorthouse, from *Blackwood's;* The Bollandists, by Rev. George T. Stokes, from the *Contemporary Review;* Isaiah of Jerusalem, by Mathew Arnold, from the *Nineteenth Century;* Concerning the Unknown Public, by Thomas Wright, "The Journeyman Engineer," from the *Nineteenth Century.*

The first of these is a sharp criticism of the writings, characters and methods of such writers as Charles Dudley Warner, W. D. Howells, and Henry James, which, though just in some respects, betrays an unwarranted degree of bitterness. The other essays are all readable and suggestive.

This series grows in favor with each number. Number 4 will consist of "Historical Sketches," by prominent writers.

A TEXT-BOOK ON THE ELEMENTS OF PHYSICS: By Alfred P. Gage, A. M. 12mo., pp. 414. Ginn, Heath & Co., Boston, 1883.

The peculiar excellence of this work, which is intended for the students of High Schools and Academies, is found in the fact that the pupil works his way through it, *i. e.*, he accepts as fact only that which he has proved by experiment or personal investigation. He is taught to think and draw his own inferences, hence the statement of principles and laws follows their discovery in the laboratory or work-room. Suggestions and questions open the way and progressive experiments lead to a full grasp of the law before it is actually formulated. The whole work is condensed into six chapters, viz: Matter and its Properties; Dynamics; Molecular Energy,—Heat; Electricity and Magnetism; Sound; Radiant Energy,—Light. Each of these is ably handled and clearly illustrated, all of the most recent discoveries and laws plainly and fully set forth, and the doctrine of the conservation of energy, which is now regarded as the basis of physical science, given due prominence. The experiments given are simple and practical, just such as almost any student can find materials for without inconvenience or expense, and the tendency of the whole treatise is to throw the student upon his

own resources and to cause him to become, as it were, an original investigator of nature's processes. More than three hundred cuts serve as illustrations and a full index closes the work, which has received the commendations of some of the best physicists and teachers of the country. After a careful examination of its plan and methods, we regard it as the most practical and thorough treatise upon physics that we have yet seen, and cordially recommend it to the teachers of the advanced schools of Missouri as a fitting text-book for their use.

MANUAL OF TAXIDERMY: By C. J. Maynard. Illustrated; 12mo., pp. 111. S. E. Cassino & Co., Boston, 1883. $1.25.

This little work is intended to meet the wants of amateur ornithological collectors, says the author, for it is written by one who has at least had the advantage of a very wide experience in collecting skins, making and mounting. He has also had the advantage of comparing his methods with those of many excellent amateurs and professional collectors throughout the country, and the results are now laid before the reader. The several topics discussed are collecting, skinning birds, making, *i. e.*, dressing, skins, mounting birds, making stands, collecting mammals, mounting mammals, mounting reptiles, batrachians and fishes. The work is well illustrated and the amateur will find a great deal in it that will be of use in learning the taxidermist's art.

MODERN LOCOMOTIVE ENGINES: By Emory Edwards, M. E. Illustrated; 12mo., pp. 372. Henry Carey Baird & Co., Philadelphia. $2.00.

This work is the completion of a series by the same author, entitled respectively "A Catechism of the Marine Steam-Engine," "Modern American Marine Engine, Boilers, and Screw Propellers," "The Practical Steam Engineer's Guide," and is published at the suggestion of numerous correspondents in different parts of the country, who have read the others with interest and profit. It is complete account of modern locomotive engines, their design, construction, and management, and is presented as a practical work for practical men. There are seventy-eight illustrations and a copious and comprehensive index. The publishers in London, who are Sampson Low, Marston, Searle & Rivington, as well as the well known house of Henry Carey Baird & Co., of Philadelphia, the original publishers will send it postpaid to any part of the world for the above named price.

In the introductory chapter the properties and peculiarities of steam are fully discussed. This is followed by chapters upon Steam Engineering, with careful instructions to engineers upon the theory and practice of the subject: The Properties of Water; Economy of Fuel; Quality of Steam; Mechanical Powers—Virtual Velocities. History of Railroads and Locomotive Building in America; Construction of Locomotives; High Railway Speeds; Recent Improvements in Locomotives, etc., concluding with nearly one hundred pages of useful notes,

tables and rules. Every engineer will find in this work many practical points beyond the mere mechanical handling of a locomotive, which cannot fail to be of great value to him, not only while on the footboard but after he has graduated from that into higher positions.

POEMS OF PASSION: By Ella Wheeler. 12mo., pp. 160. Belford, Clarke & Co., Chicago, 1883. For sale by M. H. Dickinson, $1.00.

This very elegantly and tastefully prepared book contains the outpourings of the author's soul in the form of some four-score short poems on various subjects; nearly all, however, properly enough coming within the scope of the title of the work, "Poems of Passion," though as many as fifty of them are classed as "Miscellaneous." Passionate they certainly are, all of them, and poems some of them are, but not all. The prologue or preface presents a fair sample of both the poetry and the versification which pervades the whole, and accordingly we copy it:

> "Oh, you who read some song that I have sung—
> What know you of the soul from whence it sprung?
> Dost dream the poet ever speaks aloud
> His secret thought into the listening crowd?
> Go take the murmuring sea-shell from the shore—
> You have its shape, its color—and no more.
> It tells not one of those vast mysteries
> That be beneath the surface of the seas.
> Our songs are shells, cast out by waves of thought;
> Here, take them at your pleasure; but think not
> You've seen beneath the surface of the waves,
> Where lie our shipwrecks, and our coral caves."

The "passion" appears prominently in such poems as "Love's Language," "Communism," "Guilo," "Conversion," "Delilah," "The Duet," etc., through all of which the poetical vein runs with more or less harmony and rhythm. As intimated above, we find some halting feet, some defective rhymes and some rather arid thought, but as an whole we decide these verses to be fully up to the average.

The work of the publishers is, with the exception of a few errors of proof-reading—for instance "chasée" for chassé, "VALLFY" for VALLEY, "tonight" for to-night, "today" for to-day, etc.—extremely well done.

TRANSACTIONS OF THE KANSAS ACADEMY OF SCIENCE, Volume VIII, 1881-2. Octavo, pp. 85. Kansas Publishing House, Topeka, 1883.

In this volume are combined the Transactions of the fourteenth and fifteenth annual meetings of this Association, together with the Report of the Secretary.

We find in it papers by Professors Snow, Smith, Patrick, and Carruth, of the Kansas State University; Professor George F. Gaumer, of the University of New Mexico; Professor F. W. Cragin, of Washburn College, Topeka; Erasmus Haworth, Col. N. S. Goss, S. C. Mason, Robert Hay, and E. N. Plank. Also a description by Professor A. R. Grote of the entomological specimens discovered and collected by Professor Snow, in New Mexico.

These papers are all of a practical character, showing a large amount of original investigation and research by the writers, and all tending to the development of the resources of the State of Kansas. We shall reprint some of these papers from time to time, as being exactly appropriate to and in accordance with the objects and design of the REVIEW, from its inception to the present time.

OLD ITALIAN PATTERNS OF LINEN CROSS-STITCH WORK: Collected and edited by Frieda Lipperheide, and published by Franz Lipperheide, Berlin, Germany.

This work contains two collections: No. 1 contains thirty plates, fifty-six patterns, also thirty-two pages of explanatory matter, with eighty-one engravings.

No. 2 contains fifty plates, eighty-five patterns, with thirty-six pages of instructions, and seventy-eight engravings. Both are large quartos. Price of each collection is six marks.

This is a very tasteful and useful work for ladies, and handsomely gotten up. The patterns have been selected with care, many of them were secured at the museums at Berlin, Hamburg, Vienna and Dresden; some dating as far back as the sixteenth and seventeenth centuries. This work gives complete instructions as to learning this beautiful art. It explains the patterns, materials, and the stitching, such as the ancient Greek, Italian, and Dutch stitches.

It is very highly recommended by the German press. Among others we notice the widely circulated "*Over Land and Sea*," "*Science and Art*," and other famous journals. The director of the Hamburg Museum recommends it highly also.

As specimens of typographical work, these volumes are unexceptionable. Both printing and engraving are most admirably done.

OTHER PUBLICATIONS RECEIVED.

Bulletin No. 5 of the Illinois State Laboratory of Natural History. The North American Batrachia and Reptilia found east of the Mississippi River, by N. S. Davis and Frank L. Rice. Bulletin No. 6, do., Studies of the Food of Birds, Insects and Fishes, by Prof. A. S. Forbes. The *St. Louis Medical and Surgical Journal*, September, 1883, Vol. XLV, No. 3, Thos. F. Rumbold, Editor and Proprietor; $3.00 per annum. Crop Report of the State Board of Agriculture of Kansas for July, 1883, Wm. Sims, Secretary, Topeka, Kansas. "Tech-

nical Training," an address by Dr. Thos. M. Drown before the Alumni Association of Lehigh University, June 20, 1883.

First Annual Report of New York State (Agricultural) Experiment Station, 1882, E. Lewis Sturtevant, A. M., M. D., Director. Professional Papers of the Signal Service, No. VIII, The Motions of Fluids and Solids on the Earth's Surface, by Prof. Wm. Ferrel, with notes by Frank Waldo; No. IX, Charts and Tables Showing the Distribution of Rainfall in the United States, by Lieut. H. H. C. Dunwoody, Acting Signal Officer; No. XI, Meteorological and Physical Observations on the East Coast of British America, by Orray Taft Sherman; No. XII, Popular Essays on the Movements of the Atmosphere, by Prof. Wm. Ferrel. Observations of the Transit of Venus, Dec. 6, 1882, made at the University of Virginia by Professor Francis H. Smith, LL.D., and Ormond Stone, M. A., Director of the Observatory. On the Characters of the Skull in the Hadrosauridæ: On some Vertebrata from the Permian of Illinois, by E. D. Cope. A Lecture on Man, by Chas. S. Bryant, A. M. Legends of the Northwest, by H. L. Gordon, St. Paul, Minn.

SCIENTIFIC MISCELLANY.

MONEY: ITS ORIGIN AND HISTORY.—Concluded.

H. A. HAGEN.

The treasuries of the Roman Catholic churches and monasteries contain still, in some countries, an immense amount of precious metals, which may be considered as lost forever to circulation, except in extreme calamities.

That lack of money will not become absolete is true. Lack of money can be divided into three categories: Either an individual has no money, or the State where he lives has no money, or the money itself has in fact disappeared.

The causes of the first category are mostly best known to the individual himself, and may be left to his own consideration. The third category has been spoken of before, will never cease, and will rise in proportion to the increase of the metals.

The second category—when the money has left the State—needs some explanation. That a State can meet with the same misfortune as an individual is obvious, but there are different casualties to be considered. In former times it was thought fit to stop entirely the exportation of precious metals, or, as it was said, to keep the money in the country. In 1726 and 1731 edicts were promulgated in Prussia forbidding, by heavy penalty, the export of gold and silver. The same king had paved the immense hall in his palace at Berlin with thalers,

and the balcony for the music was of pure solid silver. I am happy to say that no trace of this is left

Similar intentions forgot entirely that gold and silver lose directly a part of their value, if it is not possible to buy with them all that is needed. The best proof of this statement is found during the early times of the California gold production. The value of the California gold was directly made out by the United States Mint—the ounce of gold dust equal to $18.05, or in bars to $18.48. But the gold in California retained this value only a few months after the discovery. The amount of coined money was at the time entirely insufficient, and for the largest part needed for payment to the Custom House. Therefore, by the lack money, which was here curiously the consequence of an enormous production of precious metals, the gold dust itself became a medium for exchange. An ounce of gold dust had declined the next month (in August) from $18.50 to $16, and later on even to $10. Therefore the citizens of San Francisco together united in resolutions, of which I shall read only the last:

4. "That every merchant taking gold dust at $16 per ounce in payment is to be meritoriously acknowledged."

The consequence of the fixed value of gold was simply that all merchandise and wages rose outrageously. There is a queer relic of the old California times still in existence in Oregon, Washington and the other northern Territories. The smallest currency there is in fact a quarter of a dollar, called two bits. If anybody buys a thing and tries to pay for it with the dime just returned to him, perhaps it will be taken, but in the eyes of the merchant you see clearly that you are classified among the meanest set of customers he ever met with. Of course, you have the chance to lose 20 per cent on each dollar, and you are sure to lose 10 per cent of it.

The prohibition to export gold is similar to prohibiting an individual from spending the money he has in his pocket. If he buys with profit he grows richer than before, though the money paid by him is no longer in his pocket. It would be therefore more advisable than prohibitory to order that everybody shall buy with profit. I do not know that any such edicts are still in force, except perhaps in some Asiatic Government.

A very similar incongruity exists when the wealth of a nation is calculated according to the returns of exports and imports. Suppose a merchant has exported $100,000 worth of merchandise, and has bought with it and imported with profit goods worth $150,000. The returns quote $50,000 more imported than exported, and calculate this balance as disadvantageous to the State. But if the goods which were to be imported had been taken by pirates or lost at sea, the $100,000 more exported would show a splendid balance to the State, which in fact had grown so much poorer. Everybody is aware that the fact of receiving a large amount of money is not necessarily identical with becoming richer; the more so as the wealth of a nation, as well as of an individual, consists in the value of all he possesses, and that the money is only a part of it, and mostly a smaller part, if he is very rich. Therefore, a larger receipt of money shown by

the balance of trade cannot be considered as established proof of an increase of wealth of a country.

The increase of population and wealth throughout the whole world has been so rapid that no increase in the production of precious metals can be thought of which would be large enough to influence seriously the value of those metals. The immense production of silver by the Nevada mines has not shown a marked influence on the value of the silver. If really mountains of precious metals were to be discovered, the industry and the speculation would very soon find the right way to make the right use of them.

There lies much money on the road which only needs a keen eye to pick it up, says a German proverb; and I think the wonderful ice industry first discovered in Massachussetts is an evidence of the truth of this proverb. The deep impression made on my mind by a story told to me by the late Prof. L. Agassiz may excuse my repeating it here, though probably known to every person present. When the captain ordered to take the first ship with ice to Bombay returned, and reported that just enough ice had been left to invite the officers in Bombay to an *iced bowl*, a thing never seen there before, Mr. Tudor tapped gently on the shoulder of the captain, with the words, "You have made my fortune." The captain, believing he would be dismissed for incompetency, stood somewhat bewildered, when Mr. Tudor said, "You have shown the possibility of carrying ice to India; the next time we will arrange things better." And this was done.

The sources of wealth originate not in the money, but, besides, in our brains and in our industry—only in the productive powers of nature. As the successful use of these powers can only be based upon the intimate knowledge of them, political economy grants freely the first rank to the sciences of natural history as the real corner-stone of wealth.—*Boston Transcript.*

PERSEPOLIS.

FRANCIS L. MACE.

Here is the royalty of ruin: naught
Of later pomp the desert stillness mars;
Alone these columns face the fiery sun,
Alone they watch beneath the midnight stars.

Forests have sprung to life in colder climes,
Grown stalwart, nourished many a savage brood,
Ripened to green age, fallen to decay,
Since this gray grove of marble voiceless stoon.

Not voiceless once, when, like a rainbow woof
Veiling the azure of the Persian sky,
Curtains of crimson, violet, and gold
In folds of priceless texture hung on high!

And what have sun and shadow left to us?
What glorious picture in this marble frame
Ever, as soundless centuries roll by,
Gives this lone mount its proudest, dearest fame?

The sculptured legend on yon polished cliff
Has lost its meaning. Persia, gray and old,
Upon her bed of roses sleeps away
The ages, all her tales of triumph told.

But here Queen Esther stood; and still the World,
In vision rapt, beholds that peerless face,
When with a smile which won a throne, she gave
Joy to her king and freedom to her race.

—*October Atlantic.*

CHANGING THE COLORS OF FLOWERS BY CULTIVATION.

Our knowledge of the chemistry of vegetable pigments is not yet sufficiently advanced, for which reason the effect of artificial influence upon the color-tone of flowers has not yet received its merited attention. According to my view, tannin is an important factor in the generation of vegetable colors; it is found in almost every plant, the petals not excepted, and by the action of the most varying reagents—alkalies, earths, metallic salts, etc.—it assumes the most manifold hues from pale rose to deep black. A darker color, therefore, is produced in flowers rich in tannin, when manured with iron salts, since, as everybody knows, tannin and iron-salts dye black, and produce ink. A practical use has been made of this fact in the raising of hortensias and dahlias. The former, which in ordinary soil blossomed pale-red, became sky-blue when transplanted into soil heavily manured with iron-ochre, or when occasionally watered with a dilute alum solution. English gardeners succeeded in growing black dahlias by similar manipulations. It is well known to every florist that a change of location, that is, a change of light, temperature, and soil (replanting) occasionally produces new colors, whence it may be deduced that an interrupted nutrition of the flower may, under circumstances, effect a change of color. We see no valid reason why the well-authenticated fact of the change of color produced by manuring with iron-oxide, thereby changing the nutrition of the plant, should not be practically employed by the hot-hous gardener. Another very singular and successful experiment, in producing a change of color in a bird, has recently been made. A breeder of canary-birds conceived the idea of feeding a young bird with a mixture of steeped bread and finely pulverized red Cayenne pepper. Without injuring the bird, the pigment of the spice passed into the blood, and dyed its plumage deep red. The celebrated ornithologist Russ believes that the color of the plum-

age of birds might be altered according to desire, by using appropriate reagents. —AUGUST VOGEL, in *Popular Science Monthly* for October.

HISTORICAL DEPARTMENT JOHNS HOPKINS UNIVERSITY.

This is emphatically an age of historical study; in American history there is unprecedented activity. Among other indications of an awakened historical spirit is the appearance at short intervals of very interesting historical monographs from the Johns Hopkins University. In his eloquent "History of the English People" Mr. Green says that one studies the early popular meetings of the English communities before the conquest of England with something of the same awe with which one follows a great river back to its sources. It was with some such feeling as this that the Spectator, not long ago, found himself seated in the pleasant rooms devoted to the historical studies and researches of Dr. Adams in the Johns Hopkins University at Baltimore, where the data for American history are being so rapidly collected. The parlor floor of an old dwelling had been fitted up for the work of the historical department of the University; the walls from floor to ceiling are lined with books, including the library of an eminent German scholar to whose instruction many American students look back with profound gratitude; a long table, surrounded by comfortable chairs, accommodates the classes in history, and the entire absence of any of the conventional features of a college recitation-room is very agreeable. The atmosphere of the place gives no hint of dry recitations, but rather suggests the pleasant intercourse of a teacher with a band of students who are, as in this case, his companions in active historical research. In these pleasant rooms a very fruitful and promising historical work is steadily going on and bearing visible fruit in monographs on all manner of themes in our early history. —*Christian Union.*

VIBRATION FROM TRAINS.

At the meeting of the American Society of Civil Engineers, September 5th, a paper was read by James L. Randolph, member of the society, and chief engineer of the Baltimore & Ohio Railroad, upon "vibration, or the effect of passing trains on iron bridges, masonry and other structures." Mr. Randolph refers to the fact that double-track bridges are moved in the direction of passing trains and are consequently twisted, and strains are produced not provided for. Also that cattle-stops and open culverts where built of rubble work have the walls shaken to pieces by vibration. The remedy he has supplied for these culverts and stops has been to build them of large stone as nearly the same size as possible. The tall, thin bridge-piers and abutments on whieh iron bridges rest have their stone so much disarranged by vibration as to make it necessary to secure them with timber and iron straps. Iron bridges resting on stone pedestal vibrate

in this manner, and receive a return blow from the vibrations of the pedestal, particularly if the pedestal is of a light structure, but as the iron and the stone do not vibrate in the same period there must be times when the result is a movement in the direction of the force. The effect of this vibration has been particularly noticeable at the Harper's Ferry bridge, where there was a movement of four inches in four years. After the insertion of planks between the stone and iron, this movement ceased where the masonry of piers has a platform of timber between its foundation and rock, no displacement of stone has been noticed. Mr. Randolph contends that a monolith would be the best support for structures subject to vibration caused by strains, but that a monolith of the specific gravity of granite would give a damaging return blow. Timber would answer the purpose, but is perishable. The material which, in his opinion, is most serviceable, is an artificial stone which is about two-thirds the weight of granite, is compact, durable and with very little elasticity.—*Railway Age.*

THE MAP OF SEBASTIAN CABOT.

The library of Harvard College, in Gore Hall, has recently been enriched with a photographic fac simile of the large map of the world in the National Library in Paris, known as the map of Sebastian Cabot. This interesting memorial was discovered in Germany about the year 1844 in the house of a Bavarian curate, and, through the good offices of M. de Martius, was in that year purchased for the Paris Library. It is a large elliptical mappemonde, engraved on copper, 1 metre 48 centimetres in width, 1 metre 42 centimetres in height. Along each side of the map, that is to say outside the circle, is a table 30 centimetres in width; the first, on the left, inscribed at the head Tabula Prima, and that on the right Tabula Secunda. On these tables are seventeen legendes, or inscriptions, in duplicate, that is to say in Spanish and in Latin, printed and pasted on the map. Each legend in Latin immediately follows the Spanish original and bears the same number.

Besides these seventeen inscriptions there are five others in Spanish which have no Latin exemplars. The ancient map, composed, as we shall see further on, in the year 1544, while Cabot was yet living in Spain, contains geographical delineations of discoveries down to about that period. In representing the northeast coast of our continent, NewFoundland is laid down as a group of islands, and we easily recognize the River and Bay of St. Lawrence, Cape Breton and the Isle of St. John. The west coast of America is delineated as far north as latitude 35°, California being drawn from the well known chart made by the pilot Castillo in 1541. To the north of this, of course, is the unknown region, for nobody then knew certainly whether America and were one continuous continent or were divided by straits, and the conjectures of the geographers were at variance. But the interest in this map centres principally in its inscriptions; and, though the most of these contain little of value in a geographical or historical point of view, a

few of them are of special significance. The seventeenth inscription, by turning it into English, reads as follows:

"Sebastian Cabot, captain and pilot-major of his sacred imperial Majesty, the Emperor Don Carlos, the fifth of his name, and the king our lord, made this figure extended on a plane surface, in the year of the birth of our Savior Jesus Christ, 1544, having drawn it by degrees of latitude and longitude, with the winds, as a sailing chart, following partly Ptolemy and partly the modern discoveries, Spanish and Portuguese, and partly the discovery made by his father and himself; by it you may sail as by a sea chart, having regard to the variation of the needle," etc.

Then follows a discussion relative to the variation of the needle, which Sebastian Cabot claimed to have first noticed. Here we have the declaration that the map was made by Sebastian Cabot, pilot-major of the Emperor Charles V., and in the year 1544, at which time we know he was living in Spain and held that office. And this is accompanied by the statement that, in making the map, he was guided by the discoveries of his father, John Cabot, and himself. Description No. 8 reads thus: "This country was discovered by John Cabot, a Venetian, and Sebastian Cabot, his son, in the year of our Lord Jesus Christ, MCCCCXCIV (1494), and on the 24th of June, in the morning, which land they called 'prima vista,' and a large island adjacent to it they named the Island of St. John, because they discovered it on the same day," etc.

EDITORIAL NOTES.

THE first meeting of the winter session of the Kansas City Academy of Science was quite well attended and several new members were added to the list. The opening address was delivered by Mr. Ermine Case, the subject being The National Museum at Naples. It was extremely instructive and interesting, and will be published in full in the November REVIEW.

The Academy is now in its eighth year, and has, through the efforts of a few citizens, attained a recognized position among the scientific institutions of the country. Many of the papers read before it and published in the REVIEW have been copied in standard periodicals, both in this country and Europe, as valuable contributions to scientific literature, while its cabinet and library are creditable to it, as far as they go.

In view of the value of such lectures and such collections to a community, especially to so busy an one as this, it seems strange that they are not more freely made use of by our citizens, who can thus so easily keep pace with the scientific progress of the day. In a utilitarian point of view, when so many persons are prospecting in this vicinity for coal, iron, lead, and other minerals, a full set of fossils and geological specimens is a key to the locality, and may direct the work of the miner or save him much labor and money.

With such things in view, aside from the general information to be gained from connection with such a society, it would seem that our business men, our capitalists, our teachers, and our intelligent class generally, should foster it and with alacrity and enthu-

siasm come to its aid in its struggle to acquire a permanent home and in building up a museum and library that will be an honor to the community and State.

DR. E. LEWIS STURTEVANT, Director of the New York State Experiment Station at Geneva, among other agricultural experiments, has been testing relatively the fertility of tip, butt, and central kernels of corn. It has hitherto been the custom of farmers to select for planting only the central kernels, as being the most perfect on the ear, and consequently the most likely to produce the best grain. The results of Dr. Sturtevant's experiments, however, show a very different result: as (1) the tip kernels were the most prolific of good corn; (2) the butt kernels were more prolific of good corn than the central kernels; (3) the tip kernels bore longer ears than the other kernels, the butt kernels the next, and the central kernels the shortest; (4) the merchantable ears from the butt seed were distinctly heavier than those from the tip seed, and those from the tip distinctly heavier than those from the central kernels; (5) the butt kernels furnished more unmerchantable corn than did the central kernels, and the central kernels more than did the tip kernels.

THE publisher of the REVIEW has for sale, very low, a large, fine, new parlor organ, suitable also for college chapel, lecture room, or church. It is one of the very best styles, and can be had at a decided bargain.

THE address upon "Technical Training" referred to in the September REVIEW was delivered by Dr. Thos. M. Drown, Secretary of the American Institute of Mining Engineers, before the Alumni Association of Lehigh University, June 20, 1883. It was published by the University, and has received the highest commendations from the scientific press.

ERASMUS HAWORTH, who has contributed several valuable articles to the REVIEW within the past two years, has recently been chosen Professor of Physics in the College at Oskaloosa, Iowa. He is a graduate of the University of Kansas, and has since taken a course in the Chemical Department of Johns Hopkins University, which, taken in connection with his natural aptitude and love for scientific studies, renders his appointment peculiarly fitting.

PROF. W. H. PRATT, Secretary of the Davenport Academy of Sciences, writes us a personal letter in which he says: "I always find good things in the REVIEW, both original and selected."

No. XI of the "Johns Hopkins University Studies," of which Dr. Herbert B. Adams is editor, is entitled The Genesis of a New England State (Connecticut), and was read before the Historical and Political Science Association, April 13, 1883, by Alexander Johnston, A. M.

To any person remitting to us the annual subscription price of any three of the prominent literary or scientific magazines of the United States, we will promptly furnish the same, and the KANSAS CITY REVIEW, *besides, without additional cost for one year.*

THE question of succesful sugar-making from sorghum seems to have been finally settled in Kansas. The works at Sterling and Hutchison are now manufacturing large amounts of excellent sugar, well grained and of a high percentage of saccharine matter, as well as syrup of superior quality. It is believed that within another year enough of both will be made to supply the demands of the whole State.

THE success attend the experiment of boring artesian wells in Denver and other localities in Colorado is quite remarkable, and justifies the suggestion made by the writer, in a lecture delivered several years ago, that the time would come when such wells would not only provide water for irrigating the desert lands of the great plains, but also possibly solve the question of draining the mines of the Rocky Mountain region.

PRINCIPAL GREENWOOD, of this city, has commenced the delivery of a series of thirty lectures upon the Philosophy of Teaching, before the teachers of Kansass City and such other citizens as propose making teaching a profession or are interested in the subject. they are delivered at the High School building Friday afternoons.

ITEMS FROM PERIODICALS.

Subscribers to the REVIEW *can be furnished through this office with all the best magazines of the Country and Europe, at a discount of from 15 to 20 per cent off the retail price.*

THE *American Naturalist* stands among the foremost of the scientific periodicals of the country, and at the same time it has a host of friends among non-professional readers. It probably occupies a field intermediate between the *American Journal of Science* and the *Popular Science Monthly;* less technical than the first and less speculative than the latter. We always take it up with the certainty of being entertained as well as instructed, and are seldom disappointed. The October number presents geological articles by Prof. T. Sterry Hunt; a continuation of the report of the Naturalists' Brazilian Expedition, by Herbert H. Smith; Man's Place in Nature, by W. N. Lockington; a well-timed editorial upon Questionable Innovations in Nomenclature; reviews of late works; notes by the various co-editors upon Geography and Travels, Mineralogy, Botany, Entomology, Zoölogy, Physiology, Psychology, Anthropology, and Microscopy.

Science of August 31st apologises for an error in a statement in a previous number regarding the customs duties on periodicals, but excuses itself by saying that "our post-office regulations are so frequently changed that one can rarely tell whether he is the victim of a blunder or a whim." Inasmuch as such duties pertain solely to, and are regulated by, the Treasury Department, it would appear that an apology to the Post-office Department is now in order.

THE *Princeton Review*, edited by Jonas B. Libbey, is now in its fifty ninth year. The September number contains a reply by President Porter, of Yale College, to Mr. Charles Francis Adams' attack upon the study of ancient languages in our colleges; a tariff article by Herbert Putnam; one upon Incineration by Rev. John D. Beugless; "The Artist as a Painter," by John F. Wier, N. A.; "The Antecedent Probabilities of a Revelation," by David J. Hill, Ph. D.; "Recent French Fiction," by J. Brandner Matthews. Bi-monthly, $3.00.

WE learn from *Science Observer*, Sept. 21st, that the comet discovered by Prof. Lewis Swift on the 15th is probably that of 1812, though it has arrived some three months sooner than was anticipated. It will be within 60,000,000 miles of the earth about the middle of January, and visible to the naked eye.

THE September *Magazine of American History* comes freighted with entertaining and instructive reading in generous measure, and with thirty or more attractive illustrations. It is one of the best numbers of this standard publication yet issued. The leading article is by Gen. John Cochrane, entitled "The Centennial of the Cincinnati," and is illustrated with portraits of several of the founders.

THE October number of the *Popular Science Monthly* closes the twenty-third volume of that well-known periodical, which has had a most successful career of nearly twelve years. This number contains many valuable articles, partly original and partly selected, while the book notices and editor's table are always able, fresh, and instructive.

THE *Educational Advance*, published by Thomas H. Frame, at Liberty, Mo., and edited by Gilbert B. Morrison, improves with each number. It commenced its second volume with September, and should receive a generous patronage as a home school journal. $1.00 per annum.

W. H. McAdams, the Alton, Ill., geologist and archæologist, is now in Dakota with Professor E. D. Cope, exploring the geological formations in quest of new palæontological monsters. He is writing an account of his trip to the *Alton Telegraph*.

According to the *Scientific American*, the cable railway at the Giessbach in Switzerland is operated by water. On the arrival of a car at the upper station it is weighted with a sufficient quantity of water from a reservoir, supplied by a spring, to draw up the other car; so that each car alternately acts as a motor at a very small cost. This idea might be turned to account among the mountains of our own country, and even, perhaps, at Niagara Falls, where at present the transportation is so expensive.

The *Engineering and Mining Journal* describes an ingenious device near Virginia City, by which a Mr. Townshend substitutes sand for water in working several arastras. He lifts the sand into a reservoir by means of an endless chain of buckets, operated by a wind-mill, and then lets the sand pour in a stream upon an overshot wheel.

The *Revue D'Ethnographie*, published by M. le Dr. Hamy, and edited by Ernest Leroux, at 28 Rue Bonaparte, Paris, was founded in 1882 and has secured a firm footing among standard periodicals of the day. It is devoted to original memoirs upon ethnological and archæological subjects; to reviews and analyses of books; to accounts of discoveries and of remarkable collections; to bibliography, and to appropriate notes and queries. Annual price 30 francs, single numbers 5 francs. It is issued bi-monthly, and copiously illustrated.

Number 48 of the *Humboldt Library* presents "Life in Nature," by James Hinton, forty-eight pages, octavo, for 15 cents. This closes the volume, which consists of 600 pages of valuable popular science literature, and can be bought for $1.50, postpaid.

At a meeting of the stockholders of the Florida Ship Canal and Transit Company, on Tuesday, the board of directors was authorized to make a contract for the construction of the canal, the work to be commenced at the earliest possible day. The canal will probably take the route which *The Age of Steel* pointed out last summer as the most desirable, both as regards distance and the cost of construction per mile. The canal will be between 130 and 140 miles long, 230 feet wide, and 30 feet deep.

Besides the very valuable and interesting article upon "Early Man in America," by Prof. W. Boyd Dawkins, of which we give the greater portion in this issue, the *North American Review* for October contains an article by Prof. C. A. Young, late President of the American Association for the advancement of Science, entitled "Astronomical Collisions;" a very full discussion of the bimetal question, by Senator N. P. Hill of Colorado; a most valuable critical historical article upon the French Revolution and its histories, by Mr. Frederic Harrison; "The Saint Patrick Myth," by Moncure D. Conway, etc. An unusually popular number in our estimation.

The *American Trade Journal* quotes the London *Morning Advertiser* in advocating the ship railway system of Captain Eads, with Captain Eads to carry it out, in lieu of the ship canal of De Lesseps, with De Lesseps in charge; and hopes that such an achievement may be added to the list of those already accomplished by him.

We are indebted to Thos. Pray, Jr., editor of *Cotton, Wool and Iron*, one of the leading commercial and mechanical papers of this country, published at Boston, for the loan of the electrotypes which illustrate the very interesting article in this number of the Review upon "The Tools of the Pyramid Builders," which article is also reprinted from that paper, though it was originally written for *Engineering*.

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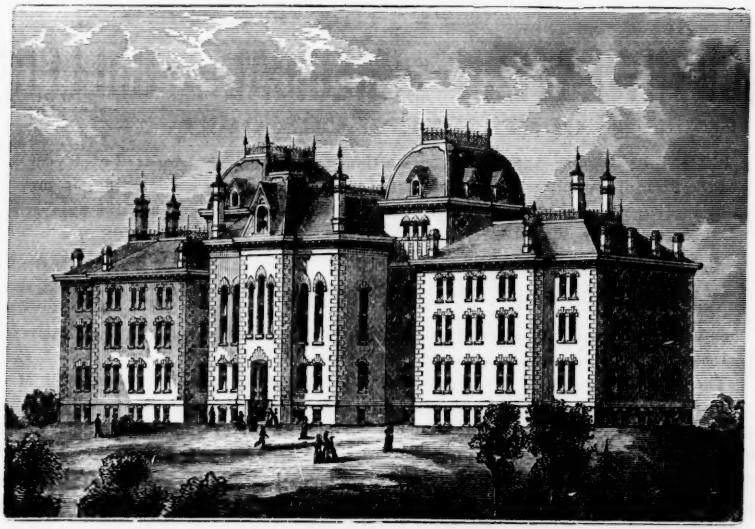

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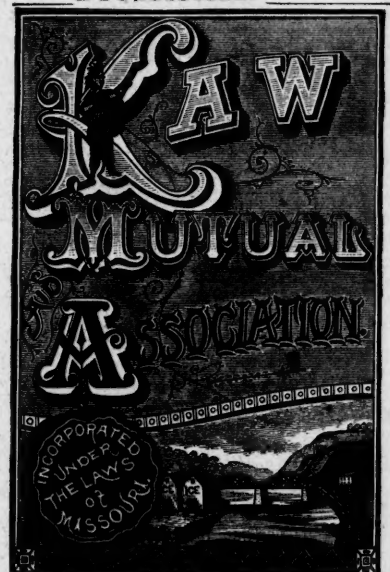

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